REPORT RESUMES

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READING FOR THE GIFTED--GUIDED EXTENSION OF READING SKILLS THROUGH LITERATURE. PART 2, APPRECIATING THE CONTRIBUTIONS OF SCIENCE THROUGH BIOGRAPHY...

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THIS TEACHING GUIDE IS DESIGNED FOR USE WITH GIFTED PUPILS AT GRADES FIVE AND SIX WHO ARE READING TWO OR MORE LEVELS ABOVE THEIR GRADE PLACEMENT. THE GUIDE ALSO PROVIDES GUIDANCE FOR THE STUDY OF BIOGRAPHY THROUGH SCIENCE LITERATURE. SUCH READING SKILLS AS ANALYZING THE AUTHOR'S PURPOSE, HIS ORGANIZATION, PERSONALITY AND STYLE, UNDERSTANDING FIGURATIVE LANGUAGE, SYMBOLISM, IMPLICATIONS, THE THEME OR CENTRAL PURPOSE, AND TONE, GAINING INSIGHT INTO HUMAN BEHAVIOR, AND UNDERSTANDING THE INFLUENCE OF ENVIRONMENT ON CHARACTER ARE DEVELOPED. THREE GROUPINGS OF BOOKS ARE USED. THE "A" BOOK IS "BREAKTHROUGHS IN SCIENCE" BY ISAAC ASIMOV. QUESTIONS ARE PROVIDED TO HELP THE CHILD TO ACQUIRE UNDERSTANDINGS IN THE AREA OF SCIENCE AND TO IMPROVE HIS PROFICIENCY IN THE USE OF READING SKILLS. THE FOUR "B" BOOKS, BIOGRAPHIES OF GALILEO, ALBERT SCHWEITZER, LOUIS AGASSIZ, AND ROBERT GODDARD, ARE USED TO DEVELOP APPRECIATIONS IN THE AREA OF BIOGRAPHICAL LITERATURE. THE 15 "C" BOOKS ARE TO BE READ INDEPENDENTLY AND USED FOR DISCUSSION. IN ADDITION TO TEACHING SUGGESTIONS, SYNOPSES OF ALL THE BOOKS ARE GIVEN. BACKGROUND INFORMATION FOR THE TEACHER, A GLOSSARY, AND A BIBLIOGRAPHY ARE INCLUDED. (RH)

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RE 000 240

READING FOR THE GIFTED

GUIDED EXTENSION OF READING SKILLS THROUGH LITERATURE

PART II

Appreciating the contributions
of science through biography . . .

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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READING FOR THE GIFTED PUPIL

This instructional bulletin, Reading for the Gifted: Guided Extension of Reading Skills Through Literature, (Part II), is designed to assist the teacher in whose classes are one or more gifted pupils reading above grade level. These books have been chosen, and this instructional bulletin developed, for the particular use with gifted pupils at grades five and six. Other groupings of materials will later be made available for pupils in other grades.

The goals of reading instruction for the gifted child are basically the same as for the pupil of any degree of ability. His potential differentiates him from pupils of lower ability in at least two major ways: the quality of his learning, and the speed with which it is possible for him to learn. The nature of his reading needs also may differentiate him from the normal pupil; as his maturing mentality and ability increase the depth and breadth of his intellectual interests, his needs for all kinds of skills of a very high order are demonstrated.

Many gifted pupils can benefit from instruction from a basal reader; this is particularly true of the pupil who is reading below grade level and the one who is reading no more than one year above his grade placement. However, pupils who are reading two or more levels above the grade to which they are assigned may more profitably use other kinds of materials.

It is recommended that such pupils receive instruction from literary materials other than a basal reader. Word recognition skills, other than extension of vocabulary, should receive minimal attention; if there are needs in this area, materials specifically designed for developing such skills should be used.

Children's literature appropriate to the interests of pupils comprising a particular reading group may be used to develop many different reading skills of a very high order. Pupils may be taught to:

Understand various literary types

Analyze the motives of fictional characters

Follow the development of plot, recognize theme, and interpret mood

Analyze the author's purpose, his organization, his personality, and his style

Understand various types of poetry, and to understand verse and stanza forms

Understand figurative language, symbolism, implications, theme or central purpose, and tone

Gain insight into human behavior

Observe and understand the influences of environment on character

Evaluate the conduct of real or fictional people on the basis of accepted standards of behavior

Skills of critical thinking can be developed through the study of literature and resource books of various types. Interest can be stimulated, and knowledge and understanding developed in history, science, and the arts using literature of these content areas for instruction in reading.

This instructional bulletin provides guidance for the study of biography through science literature. It is believed that maximum benefit will derive from following the plan presented; synopses of all the books comprising this unit of study, as well as suggestions for leading the discussion of the books to be read, are provided.

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READING LIST

A	Asimov, Isaac	Breakthroughs in Science
B	Daniel, Anita	The Story of Albert Schweitzer
	Dewey, Anne	Robert Goddard, Space Pioneer
	Forsee, Aylesa	Louis Agassiz: Pied Piper of Science
	Levinger, Elma	Galileo
C	Anderson, William	First Under the North Pole
	Asimov, Isaac	Words of Science
	Baker, Rachel	America's First Woman Astronomer
	Bendick, Jeanne	Archimedes and the Door of Science
	Carson, Rachel	The Sea Around Us
	Coombs, Charles	Lift-off; the Story of Rocket Power
	DeLacy, Estelle	Euclid and Geometry
	Hamilton, Lee	Century: Secret City of the Snows
	Hogben, Lancelot	The Wonderful World of Mathematics
	Honour, Alan	Ten Miles High, Two Miles Deep
	Miller, Helen	Woman Doctor of the West
	Newlon, Clarke	Famous Pioneers in Space
	Rich, Josephine	Pioneer Surgeon
	Watson, Jane	World of Science
	Williams, Beryl	Pioneer Oceanographer

A STUDY OF
Biography
Through
Science Literature

PURPOSES

"The scientific tradition rests first of all on a faith in mankind, in the ability of humans to understand, and ultimately, within certain limits, which are in the nature of things, to control, the environment in which we live in all its aspects: physical, biological, and social."[1] I. I. Rabi

I. TO ACQUIRE UNDERSTANDINGS IN THE AREA OF SCIENCE THROUGH A STUDY OF SCIENCE BIOGRAPHY

To recognize biography as a means of showing man's need to pioneer in the field of science

> by developing scientific attitudes about one's daily living, such as an inquiring mind, open-mindedness, and ability to withhold judgments until sufficient evidence has been secured
>
> by developing an understanding of scientific principles relating to various aspects of the environment; the earth, the universe, living things, matter, and energy

To recognize biography as a means of showing continuing progress in the field of science

> by developing an appreciation of the role of science in everyday living and of the inventions and discoveries of many persons
>
> by understanding and appreciating the contributions of science to the improvement of man's way of life
>
> by understanding that discovery of knowledge is continual, that there always is more to be discovered

To recognize biography as a means of showing man's need for a moral-ethical attitude toward the uses of science and of scientific advances for the common good

> by developing a reverent attitude toward the vastness, age, and complexity of the universe
>
> by gaining respect for the family of man through deeping one's understanding of his environment

---

[1] Wise, Congleton and Morris, ed., The Meaning in Reading. (New York: Harcourt, Brace, 1953), p. 106.

II. TO IMPROVE PROFICIENCY IN THE USE OF READING SKILLS THROUGH A STUDY OF SCIENCE BIOGRAPHY

To gain insight into human behavior through a study of biography

by learning to empathize with scientists of many types through an understanding of their hardships, perseverence and pathos

by understanding the worth of perseverance and noting how different scientists used various methods to overcome problems

by meeting vicariously with pioneers in science from other environments and cultures

by identifying traits of character that were helpful in times of crises

by understanding the significance of many types of people by estimating the influences of other persons upon the scientist

by evaluating bias which is the result of a person's environment, education, and experiences

To observe the influence which environment has had upon the scientist through a study of biography

by observing how success and failure stemmed from environmental conditions

by observing man's ultimate responsibility for his own behavior, regardless of the circumstances

by observing changes in points of view of people and of nations

To understand other times and places through a study of biography

by being able to "transport" oneself easily to earlier periods of world history

by recognizing differences of environment in various parts of the world

by discerning emotional aspects of other cultures, both past and present

by observing how ideas developed into forces in action in different cultures, both past and present

To gain experience in the use of the critical reading skills as an aid in the interpretation of biographical literature

by comparing ideas, situations, characters, etc.

by grasping implied ideas and by making inferences

by noting likenesses and differences

by recognizing the author's intent

by building an appreciation of vivid vocabulary

by determining a significance of a story

by seeing cause and effect relationships

by drawing conclusions

To gain experience in the use of organization skills as an aid to research in the area of biographical literature

by arranging ideas, facts, and ideas which involve time and sequence

by classifying

by choosing main ideas

by outlining

summarizing

III. TO DEVELOP APPRECIATIONS IN THE AREA OF BIOGRAPHICAL LITERATURE

To understand more consciously the unique qualities of biography

by appraising the soundness of ideas

by appraising the authenticity and accuracy of information

by determining the author's purpose

by recognizing the organization of fact and sequence of events

To increase sensitivity to an author's style through an evaluation of

the use of figurative language

the connotation of words (semantics)

the ease of reading

the beauty of language

STUDY
OF
“A”
BOOKS

Breakthroughs in Science

By

Issac Asimov

SYNOPSIS

BREAKTHROUGHS IN SCIENCE

by Isaac Asimov

Isaac Asimov discribes the astonishing achievements of that small group of scientists who have broken through to new worlds for mankind. Working for the most part alone in their laboratories, they were the first to venture into uncharted and awe-inspiring areas of throught. The results of their leaps into the unknown affect our lives every day.

There are Archimedes, who showed how one man could drag a heavy ship and whose inventions even today are relieving men from back-breaking work; Copernicus and Galileo, who laid the foundations of modern astronomy; Jenner, the first man to use vaccination; Marie and Pierre Curie, who paved the way for the Atomic Age; Robert Goddard, the father of modern rocketry; and many other contributors to every field of science.

As in anything Professor Asimov writes, the book is unfailingly entertaining, as well as informative. When this material was first serialized in Scholastic Magazine, the response was so favorable that it was published in its present permanent form.

On the book jacket it is pointed out that the breath-taking advances that science has made in recent years tend to obscure the important and dramatic work of earlier pioneers; yet, it was their discoveries that made our present knowledge possible. This book will restore the perspective for younger readers, giving them a wealth of historical information, and providing an inspiration for those planning a career in science.

ABOUT THE AUTHOR

Isaac Asimov was born January 2, 1920, in Petrovichi, Russia. His Parents brought him to the United States, and they became naturalized citizens in 1928. In 1939 Isaac was graduated with the degree of Bachelor of Science from Columbia University, and received his master's degree in 1941 and his doctorate (in enzyme chemistry) in 1948.

From 1942 to 1945, Mr. Asimov worked as a chemist in the Naval Air Exploratory Station in Pennsylvania. In 1949, he joined the faculty of the department of biochemistry in the Boston University School of Medicine, where he continues to teach.

The 1964-65 Edition of Who's Who in America credits Dr. Asimov with having written 21 books, among which are: Pebble in the Sky (1950), I. Robot (1950), The Stars, Like the Dust (1951), The Naked Sun (1957), Words from Myths (1961), and The Human Body (1963).

OUTLINE TO AID IN THE STUDY OF BREAKTHROUGHS IN SCIENCE

Pages 11 through 19 contain the major dates and the contributions of the scientists whose lives are reviewed in Breakthroughs in Science.

Information has been listed in chronological order and does not necessarily follow the order of presentation in the book.

The following information will be found in this outline:

1. The pages in Breakthroughs in Science on which each scientist's biography is presented
2. The years of each scientist's birth and death
3. Information as presented in the book, about the scientist's background and education, and related information
4. A list of each scientist's contributions, discoveries, or inventions

NOTE An asterisk (*) has been placed before those items which seem to be the most significant contributions of the scientist, or before statements which show or state the impact of the scientist's work.

Example

Gutenberg invented movable type.

*Triumph of TECHNOLOGY

*Result in rapid dissemination of information

PAGES	CONTRIBUTION	SUBJECT	GEN'L. INFO.	LIVED
1-8	developed system that resembled integral calculus set up theories that explain basic mechanics of lever discovered principle of displacement (deduced laws of buoyance and specific gravity) *applied science to problems of everyday life	**ARCHIMEDES**	greatest scientist of Ancient World from aristocratic background attained fame during life time.	287-212 B.C.
9-16	invented movable type *a triumph of TECHNOLOGY *resulted in rapid dissemination of information	**GUTENBERG**	well-to-do background plagued by bad luck did not achieve fame during lifetime	1395 A.D.-1468 A.D.
17-25	presented theory that earth traveled about the sun *proved soundness of theory through LOGIC *resulted in a change of man's relationship to universe (earth now only one body among others in tremendous universe) *man now stood face to face with the challenge of infinity	**COPERNICUS**	talented in many pursuits practiced medicine statesman astronomer	1473-1543
31-40	discovered the law of the pendulum disproved Aristotle in theory of falling bodies discovered moons of Jupiter (each had own orbit) disproved notion that everything rotated about earth found way to measure weight of bodies in water devised thermometer to measure temperature built water clock to measure time proved air has weight first to use telescope in astronomy *discovered the laws that govern force and motion and the speed of moving objects (stated these laws in mathematical formulas)	**GALILEO**	talented in all areas famous for writings opposed by the church renowned while living	1564-1642

PAGES	CONTRIBUTION	SUBJECT	GEN'L. INFO.	LIVED
	*demolished pedantic approach to science *first to arrive at his conclusions by the modern scientific method of combining observation with logic			
26-30	discovered circulation of blood *importance of work was in methods used (used observation) *his work was the beginning of Life-Sciences	HARVEY	court physican called a "quack"	1578-1657
41-44	discovered living organisms not visible to naked eye first to see blood moving through living capillaries discovered red corpuscles *discovered bacteria *first to demonstrate what could be done with microscope *work resulted in a basis for most of modern biology	LEEUWENHOEK	made lenses for hobby humble background famous while alive	1632-1723
45-53	discovered that light was made up of various colors that could be separated and combined worked out binomial theorem for expressing certain algebraic quantities *discovered a new way for calculating areas bounded by curves (now called calculus) *developed reflecting telescope proved that moon was held in position by earth's gravity (moved in an ellipse) *developed his laws of motion (his law that for every action there is an equal and opposite reaction, explains the principle upon which rocket engines work) (his laws of motion completed the work done by Galileo) (his laws of universal gravity explained the work of Copernicus)	NEWTON	professor of math at Cambridge was idolized during his lifetime	1642-1727

PAGES	CONTRIBUTION	SUBJECT	GEN'L. INFO.	LIVED
5 58-66	recognized that combustion and life depend upon oxygen developed the law of Conservation of Mass established logical rules for the naming of chemical compounds published first modern chemistry text-book (called "Father of modern chemistry") *realized the importance of accuracy (greatest single contribution quantitative analysis)	LAVOISIER	well-to-do background	1743-1794
90-98	developed vaccination against smallpox *thus he had discovered a way to prevent a disease, rather than to cure one (the use of the body's own machinery to develop immunity) (he founded the science of immunology)	JENNER		1749-1823
54-57	improved the efficiency of the steam engine (a triumph of technology) *efficiency of engine allowed large amounts of power to be concentrated in small area: factories and mass production became possible *caused the beginning of the Industrial Revolution invented centrifugal governor *beginning of automation	WATT		1736-1819
67-75	research that led to modern concept of the electron discovered how to make magnetism induce an electric current to flow Electro-magnetic induction invented first electric generator built first version of a transformer *his discoveries led to the first practical method of turning mechanical energy into electrical energy	FARDAY	modest background	1791-1867

PAGES	CONTRIBUTION	SUBJECT	GEN'L. INFO.	LIVED
76-84	made the electromagnet important (developed large and small electromagnets) invented the relay invented the first motor made possible the establishment of the U.S. Weather Bureau *his inventions led to the development of the telephone by Bell and of the telegraph by Morse	**HENRY**	came from poor family taught mathematics at Albany Academy	1797-1878
85-89	invented the rotating projectile invented the Bessemer process of making steel *this made possible the use of America's vast iron ore resources *inexpensive steel led to fantastic engineering achievements	**BESSEMER**	rich and famous during his lifetime	1813-1898
99-106	discovered that molecules could be "right-handed or left-handed" developed pasteurization disproved spontaneous generation *discoveries led to Lister's Antiseptic surgery, sterilization of medical instruments, germ theory of disease, inoculation against anthrax, chicken cholera, and hydrophobia, safe drinking water, science of sewage-disposal, sterile commercial preparation of food, disinfectants, and warfare against germ carriers (rats, mosquitoes) *resulted in longer life expectancy 1850-American male, 38 years 1959-American male, 68 years	**PASTEUR**		1822-1895

PAGES	CONTRIBUTION	SUBJECT	GEN'L. INFO.	LIVED
107-110.	produced hybrid seeds stated first law of inheritance showed characteristics of dominance and recessiveness *led to science of genetics *led to hints of routes taken in migration of primitive man	MENDEL	peasant parents lived as a Monk in a monastery died unrecognized	1822-1884
110-119.	discovered first artificial dye (from coal tar derivativies) *led to the opening up of a new world of color *led to great emphasis in organic chemistry synthesized coumarin *led to ways of synthesizing perfumes *importance - synthetics could improve on nature led to synthetics in other fields (fabrics, rubber, drugs, etc.)	PERKIN		1838-1907
120-127.	discovered X rays led to great advances in the field of medicine *began a new scientific revolution	ROENTGEN	trained as a mechanical engineer	1845-1923
120-127.	discovered that uranium emits X rays this discovery led to an understanding of the nature of the cathode ray (theory of sub-atomic particles-electrons) (identified gamma radiation, electrons, and helium nuclei as coming from uranium rays) *caused a complete revolution in physics *led to nuclear physics	BECQUEREL	son of an eminent scientist	1852-1908

PAGES	CONTRIBUTION	SUBJECT	GEN'L. INFO.	LIVED
128-136.	a professional inventor called the "Wizard of Menlo Park" patented more than 1000 inventions during lifetime improved telephone and made it workable invented the phonograph invented electric light bulb discovered only one phenomenon (the Edison Effect - made possible the radio tube) *inventions were put on a mass-production basis *greatest contribution - the idea of continuous, inevitable progress	EDISON	average student mostly self-educated published newspaper to raise money became a telegrapher	1847-1931
137-144.	used dyes to stain cells and bacteria helped establish "side-chain theory" (explanation of how antibodies were formed and how they worked) *worked out a treatment for prevention of diphtheria using antitoxin (serum-therapy) *began the science of killing disease germs with chemicals (chemotherapy) led to eventual perfection of sulpha drugs and penicillin	EHRLICH	became a physician	1854-1915
145-153.	developed theory of "Survival of the fittest" collaborated with Darwin	WALLACE	explored around the world a naturalist	1823-1913

PAGES	CONTRIBUTION	SUBJECT	GEN'L INFO.	LIVED
145-153	discovered that a "species" only breeds with its own kind concluded that a "species" changed *developed the theory of "natural selection" wrote the book The Origin of Species thought of as the originator of "The Theory of Evolution" *importance - presented a tremendous amount of evidence and logical reasoning to back up his theories	DARWIN	from a distinguished family began to study medicine became a naturalist worked as a naturalist on a five year sea voyage around the world	1809-1882
154-162	discovered that thorium gives off rays similar to uranium rays discovered polonium discovered radium	MARIE CURIE	born in Poland moved to Paris attended the Sorbonne married Pierre Curie, 1895 high interest in radio-active materials received two Nobel Prizes first woman professor at the Sorbonne *considered one of the greatest women of history died of leukemia	1867-1934
154-162	discovered "piezoelectricity" (used in radio transmitters) devised electrometer (could measure small amounts of current) joined wife in her search for radio-active materials	PIERRE CURIE	Son of Paris physician worked with brother on properties of crystals worked with Henri Becquerel received Nobel prize killed in tragic traffic accident	1859-1906

PAGES	CONTRIBUTION	SUBJECT	GEN'L. INFO,	LIVED
163-171.	*advanced the theory that matter and energy are different aspects of the same thing *developed theory of relativity (led to a correction of Newton's theories) received Nobel Prize for logical explanation of the"photoelectric effect" explained theories dealing with "Brownian movement" *Einstein theory led to the eventual development of the atomic bomb	EINSTEIN	not considered a bright child director of Kaiser Wilhelm Physics Institute immigrated to United States as a result of Jewish persecution in Germany became a citizen of the Unites States in 1940 joined the Institute for Advanced Studies at Princeton	1879-1955
172-176.	showed how land could be reclaimed developed rotation of crops to restore nitrogen to the soil *led to restored land - improved crops and improved income *led to development of synthetic products from peanuts and sweet potatoes introduced soybeans from China *his research in chemistry accomplished wonders in agriculture	CARVER	a slave during the civil war supported himself while going to school received a Master of Science degree at Iowa State Agricultural College became director of Tuskegee's Department of Agricultural Research received many awards	1864-1943
181-189.	discovered what the inside of an atom is like identified differences in alpha and beta rays worked out the rate at which a radioactive substance breaks down discovered way to detect individual sub-atomic particles *first to change one element into another (first man-made nuclear reaction) *turned radio-activity from a phenomenon into a tool	RUTHERFORD	scholarship at Cambridge	1871-1937

PAGES	CONTRIBUTION	SUBJECT	GEN'L. INFO.	LIVED
177-180	invented the gas-filled light bulb invented a hydrogen blow-torch (6000 degrees) received Nobel Prize for work in surface chemistry discovered rain-making through use of dry ice and silver iodide crystals *led to science of controlled weather	**LANGMUIR**	traveled constantly as a child became a metallurgical engineer received Ph.D. in physical chemistry worked for General Electric	1881-1957
181-189	developed the "cyclotron" *led to smashing of the atoms *led to the use of atomic power in industry and in war	**LAWRENCE**	attended University of California	1901-1958
190-193	experimented in rocketry wrote a book in 1919 on the theory of rockets 1923-used gasoline and liquid oxygen as propellant 1926-sent up first rocket developed many of the ideas used in present day rockets developed system for steering rockets patented multi-stage rockets *led to present-day conquest of space	**GODDARD**	Ph.D at Clark University taught at Princeton called a "crackpot" worked through a grant from Smithsonian Institution Guggenheim helped finance experiments financed by government during World War II German advances in rocketry were based on Goddard's research	1882-1945

TEACHING SUGGESTIONS FOR BREAKTHROUGHS IN SCIENCE

In this section, the teaching suggestions are organized around various themes which bring together the contributions of several scientists whose research had an impact on some particular phase of science. For example, the theme is the "space age" which considers first Robert Goddard but also includes the selections about Archimedes, Copernicus, Gallileo, Einstein, and Newton, all of whom contributed to the recent achievements in space exploration which are of particular interest to many pupils.

Other themes seek to relate other groups of scientists who have had similar relationships, although they may have lived at widely disparate times.

INTRODUCTION TO THE "A" BOOK

1. Have children skim through Breakthroughs in Science to discover the general content of the book.
2. Discuss the meaning of the word breakthrough.
3. Discuss one or two of the illustrations.
4. Turn to page 191 and discuss the illustration of the rocket.
5. Establish purposes for reading, such as, in the case of Goddard, for example:
    a. To find out why Goddard is called the "Father of Rocketry."
    b. To find out how a rocket works.
    c. To learn about the difficulties Goddard experienced.
6. Have children read silently the biography of Robert Hutchings Goddard beginning on page 190.

PURPOSES AND GUIDING QUESTIONS

to show man's need to pioneer

Why was the success of the first rocket considered to be as important as the flight of the Wright brothers at Kitty Hawk?	(See p. 190)

to understnad other times and places	
Why do you think few cared about Goddard's work with rockets?	
to appraise soundness of ideas	
Why do you think the rocket continued to rise after the fuel was exhausted?	
In what way was this criticism justified and in what way was it not justified?	
to relate ideas to a larger frame of reference	
What role does science play in war?	improvement of instruments of war
Why is a nation more likely to encourage scientific achievement during a national emergency?	need is more apparent in wartime desire for economy during peace time
In a way, Russia and the United States were competing in rocketry, even back in 1919. Why do you think this was possible?	
to build vocabulary through context clues	
What is meant by the word theory?	(See Glossary)
to acquire understandings in the area of science	
What is necessary to establish a theory?	
What is necessary to establish a hypothesis?	
to draw conclusions	
Goddard sent up a barometer, thermometer, and a small camera in one of his rockets. How do you think he was able to do this and still recover his instruments?	

to empathize with other people

Why do you think Goddard was called a "crackpot"?	(See p. 192)

to estimate the influence of other lives

What influence does an uneducated public have in the advancement of science?

to gain insight into human behavior

How did Goddard show his concern about proving his theories of rocketry?	perseverance belief in his work

to acquire understandings in the area of science

What is the V-2 rocket?

to show man's need for a moral-ethical attitude

Do you think that men of all nations have moral-ethical attitudes? Why, or why not?	
How can the misuse of knowledge be harmful to mankind?	control of captive nations by force
What benefits to mankind do you feel could come from the conquest of space?	

ARCHIMEDES, pages 1 - 8

Archimedes said, "I can move the world." Have children read pages to discover what he meant.

to understand other times and places

What things hindered Archimedes in his work?	Greek numbers constant warfare
What conditions were favorable to his work?	intellectual environment fame and respect good education

to appraise the soundness of ideas	
How did Archimedes use his discoveries for the solution of practical problems?	inventions
What discoveries of Archimedes are still valid today?	
to acquire understandings in the area of science	
What is meant by an abstract theory?	(See Glossary)
to note likenesses and differences	
In what way was Archimedes different from the Greek mathematicians that preceded him?	put his theories to work
to grasp implied ideas and make inferences	
Our book states on p. 6, par. 5, that Archimedes discovered the principle of displacement in a flash of intuition. What is the meaning of "intuition" as used in this biography?	
to draw conclusions	
Was this "flash of intuition" mentioned above based on Archimedes' accumulation of knowledge? Substantiate your conclusion.	
to identify traits of character	
In what way did Archimedes evidence qualities of courage?	(See p. 8, par. 1.)
to recognize man's need to pioneer	
Aside from his discoveries, what do you consider to be Archimedes' greatest contribution to man?	applied science to solve problems of everyday life

to show man's need for a moral-ethical attitude

On p. 8, the last paragraph says; "Today we believe that the great duty of science is not only to understand the universe, but also to better the lot of mankind in every corner of the earth." What is your interpretation of this statement?

COPERNICUS AND GALILEO pages 16-25 and 31-40

After a discussion of Archimedes, have children read about Copernicus, and Galileo.

Ask children to find:

- theories or discoveries that show a difference of opinion between Galileo and Copernicus
- theories that differed from those presented by Archimedes
- theories that seemed to support the findings of Archimedes

Begin discussion by talking about the backgrounds of Archimedes, Copernicus, and Galileo.

to observe the influence of environment

What were the similarities of background?	famous family backgrounds
What persons were most likely to obtain an education during the times of Archimedes, and later during the times of Copernicus and Galileo? Why?	persons who were wealthy
Do you think these men would have contributed to the growth of science had they not been educated? Explain.	
How have opportunities for education changed?	easier for man to receive higher education; compulsory education

How have today's opportunities for education affected the progress of science?	more scientists; greater dissemination of knowledge
to appraise the soundness of ideas	
How did Copernicus develop his theory that the earth traveled around the sun?	observation
How did his method of discovery differ from the method Galileo used when he discovered the laws that govern force and motion and the speed of moving objects?	use of telescope (observation) use of mathematics
What is meant by "logic"?	(See Glossary
to understand other times and places	
Why were the theories of Copernicus not accepted by most governments, scientists, and other schools of thought?	tendency of the times was to not question previously accepted theories
to relate ideas to a larger frame of reference	
Do you think man is willing to accept radical changes in thought and opinion? Why, or why not?	

NEWTON, pages 45-53

Have children read to discover why Newton developed the reflecting telescope

to meet vicariously with pioneers in science from other environments and cultures	
Why do you think Newton was idolized?	
to develop the understanding of a scientific principle	
Newton was able to explain why the moon remains in orbit and is not drawn to the earth by the earth's	held in orbit by gravity, moon travels in an ellipse, and the force of gravity and inertia are in balance

gravity. How did he explain this theory?

What tool was necessary to prove this theory?

calculus

to appreciate the contributions of science

How do you think Newton's mathematical genius affected the progress of science?

to understand that the expansion of knowledge is continuous

Was Newton able to disprove accepted theories in science? If so, how?

advanced mathematics

to observe how ideas developed into forces of action

What do you think was Newton's most far-reaching or important contribution to mankind? Support your reasoning either by facts, or by logic, or both.

On p. 53, it is stated, "From Newton's day, science has been filled with a self-confidence that never again faltered." What is meant by this statement?

EINSTEIN, pages 163-171

Ask the children to share what they know about Einstein before they read.

Read about Einstein to substantiate or to disprove something the children have stated.

Talk about Einstein's theories dealing with matter and energy.

Talk about the speed of light.

Ask the children what would happen if man could travel faster than light.

to show continuing progress in the field of science

Einstein's theory of relativity led to a correction of some of Newton's theories. What can we conclude from the fact that Einstein's theories changed the theories of Newton?

theories can be subject to modification or correction

Newton's theories changed the theories of Galileo. Galileo's theories changed the theories of Copernicus. Discuss.

Archimedes, Copernicus, Galileo, Newton, and Einstein all were astronomers and physicists. What was their most important tool for investigating and proving their theories?

to note likenesses and differences

Do you feel there is any similarity between mathematics and logic? If so, why?

to draw conclusions

If Germany had perfected the atom bomb before the United States, do you believe that the outcome of World War II might have been different? Explain.

to show a need for a moral-ethical attitude

What responsibilities rest upon countries that control vast power, such as the atomic bomb?

# # # #

HARVEY, pages 26-30

Have children read to discover what method of research Harvey used.

observation

to empathize with scientists of many types and to compare ideas, situations, characters	
Like Goddard, Harvey was called a "crackpot". Why?	(See p. 29, par. 3.)
to recognize continuing progress in the field of science	
Whose theory about the circulation of the blood did Harvey disprove?	Galen
to recall information	
What method of investigation did Harvey employ in formulating his theory?	observation
to grasp implied ideas and make inferences	
What did the author imply on p. 30 about the use of ancient manuscripts?	
to draw conclusions	
In what ways do you think that ancient manuscripts were of value?	
to show continuing progress in the field of science	
Physicians were prevalent before the time of Harvey. Why, then, do you feel that Harvey was responsible for the beginnings of life-science?	

VAN LEEUWENHOEK, pages 41-44

to draw conclusions	
Van Leeuwenhoek was not a physician, yet his discoveries changed the course of medicine. Why were his discoveries so important to the advancement of medicine?	magnification of minute objects

to note likenesses and differences

Van Leeuwenhoek made his discoveries as a direct result of his hobby. In what way was his hobby different from other hobbies?

to draw conclusions

Do you think Van Leeuwenhoek should be considered a scientist? Why, or why not?

to identify traits of character

Van Leeuwenhoek possessed many of the character traits of other scientists. What do you think some of these characteristics were?

to relate ideas to a larger frame of reference

In what ways did Van Leewenhoek's work become the basis for modern biological study?

JENNER, pages 90-98

Have children read to find out how Jenner developed a way to prevent a disease.

to understand other times and places

Why do you think England was so slow in honoring Jenner for his work? (See p. 96, par. 6.)

to recognize man's need for a moral-ethical attitude

In what way did Jenner show concern for mankind? (See p. 91, par. 2.)

to identify traits of character

What traits of character do you think Jenner possessed?

to note how different scientists used
various methods to overcome problems
to draw conclusions

Jenner took a tremendous chance when he vaccinated his first human. Can we justify his experimental work on humans? If so, how?

Would a doctor work in this manner today? Why, or why not?

to draw conclusions
to compare ideas, situations

Jenner rightly has received credit for perfecting a vaccination against smallpox. However, the Turks apparently were doing the same thing, but without any scientific basis. Do you feel the Turks also should receive recognition for the development of a way to prevent smallpox? Why, or why not?

to relate ideas to a larger frame of reference

Do you believe that a true humanitarian or scientist is concerned about personal glory?

to observe how ideas developed into forces in action

What influence did Jenner's work have on humanity?	life span extended
How did Jenner's work help man to eradicate other diseases?	transfer of knowledge to a different situation

to develop an understanding of scientific principles

Does vaccination actually kill the disease?	helps build antibodies

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PASTEUR, pages 99-106

to observe how ideas developed into forces in action	
As a scientist, Pasteur made discoveries that changed the course of medicine. Why would Pasteur's discoveries have been impossible without the microscope?	necessary to see bacteria
to show continuing progress in the field of science	
How was Pasteur able to disprove the accepted theory of spontaneous generation?	organisms do not live in a sterile environment
to acquire understanding in the area of science	
What is meant by the germ theory of disease?	the causative agent for all diseases is germs
to see cause and effect relationships	
What were the results of Pasteur's discovery that germs cause disease?	disinfectants sterile procedures pasteurization of milk boil or chemically treat water
relating ideas to a larger frame of reference	
In what ways do you think Pasteur's work has changed the living conditions of man?	increased life expectancy less illness
How did Pasteur's work affect the life expectancy of man?	(See p. 106, par. 3.)

MENDEL, pages 107-110

Mendel is another example of a man who made important discoveries as the result of a hobby. Have the children read to find out how Mendel's hobby differed from Van Leeuwenhoek's.	it was necessary for Mendel to be a statistician Van Leeuwenhoek's work was a skill both men used observation

to understand other times and places

Since Mendel was an amateur, scientists would not pay attention to his work. Why do you think it was possible for his research to go unnoticed?	isolated in his work amateurs not given much recognition disinterest

to gain insight into human behavior

Why do you think the three scientists who rediscovered Mendel's laws of inheritance were willing to abandon their claims and to give full credit to Mendel?

to recall information

What is meant by the word "hybrid"?	(See pp. 108-109.)
How did statistics help Mendel prove his theories? Explain.	

relating ideas to a larger frame of reference

How have Mendel's laws aided in the improvement of crop production?	plants with desireable characteristics have been developed
How do you think the study of genetics will aid mankind in the future?	

# # # # #

EHRLICH, pages 137-144

to recall information

How did Erhlich use dyes to identify bacteria?	(See p. 138, par. 4.)

to draw conclusions

What is meant by, "these antibodies must work the way his dyes did. They combined with some cells and not with others.?"	(See p. 139, par. 2.)

How do you think Ehrlich was able to work out the form of a molecule?	(See p. 141, par. 5.)
What is meant by the term "magic bullet" on page 142, par. 2?	
The chemical 606 was rediscovered by another assistant. What part did the element of chance play in its rediscovery?	law of probability

to understand the worth of perseverance

How did the element of human error enter into Erlich's research?	(See p. 142)
Could such error have been avoided? If so, how?	more carefully controlled experiments

to relate ideas to a larger frame of reference

What role does "chance" play in scientific developments?

Discuss the following terms:
educated guess
law of averages
deduction
statistics
hypothesis

to grasp implied ideas

What is meant by the term chemotherapy?	(See p. 144, par. 4.)
How has chemotherapy changed our lives?	led to development of penicillin

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PERKIN, pages 111-119

Perkin's discovery of a dye was another example of "discovery by accident."

to recall information	(See p. 111)
What was Perkins original goal when he worked with coal tar?	

What were the factors that led to Perkin's decision to become a chemist?	(See p. 113.)
from what were dyes made before the time of Perkin?	natural organic material (roots, leaves, etc.)
to estimate the influence of one person on another	
How was Michael Faraday able to inspire the young Perkin	(See p. 113)
to grasp implied ideas and make inferences	
Why do you think chemistry was not respected in schools?	importance not realized
Why was Germany able to make rapid advance in the field of dye making?	(See p. 116.)
How did Perkin show that synthesis could be an improvement on nature?	(See p. 118.)
to identify traits of character	
What were the obstacles that Perkin faced in setting up a factory for dye production?	(See p. 114.)
What traits of character must he have possessed?	(See p. 115.)
relating ideas to a larger frame of reference	
What do you think the world looked like before the discovery of synthetic dyes?	
How did Perkin's work affect the production of other synthetic materials?	(See pp. 118-119.)

LAVOISIER pages 58-61

to observe how success and failure stemmed from environmental conditions

what did the author mean by the statement, "It was probably the greatest single loss of the revolution?"	
to gain insight into human behavior to show man's need for a moral-ethical attitude	
Admittedly, Lavoisier was a great and gifted chemist. However, he used tax monies to develop his own research laboratories. How do you feel about this?	discuss moral standards
to draw conclusions	
Do you think the government should have supported Lavoisier's work?	
When we read about Goddard's work on rockets, we found that the government showed little interest. How did Goddard pursue his research? Who supported his research and why?	tried to obtain contributions from private sources
What do you think was Lavoisier's greatest contribution?	(See p. 63.) quantitative analysis - importance of accurcy
to show continuing progress in science to recall information	
Why is Lavoisier called the "Father of Chemistry?"	(See p. 65.)
What were some of his contributions?	
What do you know about the unrest in France before the "Reign of Terror"?	
to acquire understandings in the area of science	
What is meant by "Law of Conservation of Mass?"	(See p. 63.)
to relate ideas to a larger frame of reference	
How can Lavoisier's example be applied to our own science experiments?	well-planned accuracy

ROENTGEN AND BECQUEREL pages 120-127

to relate ideas to a larger frame of reference

How has the discovery of the X-ray helped advance the science of medicine?	dentistry cancer prevention, etc.
How have X-rays played a role in industry?	

to note likenesses and differences

What is the difference between luminescence and fluorescence?	(See Glossary)
How do rays of radiation differ from cathode rays?	(See Glossary)

to acquire understandings in the area of science

What do you think is happening to the uranium salt as it gives off its constant radiation?	(See p. 124.)

MARIE AND PIERRE CURIE pages 154-162

to identify traits of character
to understand the worth of perseverance

Madame Curie is considered one of the greatest women of history. What traits of character did she evidence in her search for a radioactive substance?	dedication perseverance
What obstacles impeded the Curies' during their research?	monetary weather

to estimate the influence of one person on another

What role did Madame Curie's husband play in her scientific career?

How do you think Henri Becquerel might have had some influence upon Marie Curie's career?	(See p. 154, par. 5.)

to understand other times and places

Why did Marie Curie move to Paris?

to draw conclusions

Do you feel that "chance" was a factor in the Curie's discoveries? Explain your answer.

In what ways can we support the author's opinion that the Curies' work was of a dramatic nature?

to compare likenesses and differences

How did the Curies' research procedures differ from those of earlier pioneers in the field of chemistry?	used scientific method

to see cause-and-effect relationships
to recognize science as a continuing process

How did the work of the Curies influence modern discoveries in the field of radiation?	led to intense research

appraising the soundness of ideas

Madame Curie was the first great woman scientist. Did this fact have any social significance?	gave status to women scientists

# # # # #

WATT pages 54-57

to show man's need to pioneer

Why was the first steam engine built by Thomas Newcomen inefficient?	(See p. 54.)

to gain insight into human behavior	
On p. 54, par. 4, the author states that Watt began to study steam scientifically. What does this statement mean?	arrived at theoretical solution
to appreciate the contributions of science to the improvement of man's way of life to draw conclusions	
What is meant by "a triumph of technology"?	
How did the efficient use of the steam engine change the standard of living?	
Watt suddenly developed a solution to the problem. Can his solution be considered a hypothesis? Why, or why not?	(See Glossary hypothesis.)
to develop an understanding of scientific principles	
How did Watt employ the law of gravity in perfecting his safety valve?	(See p. 57.)
to show continuing progress in the field of science	
What is meant by the term "automation"?	mechanical control - no need for manpower - automatic (See Glossary.)
relating ideas to a larger frame of reference	
What part does automation play in our lives today?	
What are the social implications of automation?	more leisure time

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FARADAY pages 67-75

to observe the influence of environment

What "stroke of luck" was helpful in Faraday's education	(See p. 68.)

to develop scientific attitudes

What deductions did Faraday make in coming to his conclusion that a magnetic field could generate electricity?	(See p. 70.)

to recall information

What is a galvanometer?	(See p. 70.)

to acquire understandings in the field of science

Why was motion a necessary factor in the flow of current?	(See p. 71.)
Explain "electro-magnetic induction."	(See pp. 71, 72.)
Discuss amperage and voltage.	(See pp. 72, 73.)
How is it possible to convert energy in the form of water power and fuel into electrical energy.	(See pp. 73-75.)

to draw conclusions
to appraise the soundness of ideas

What was considered Faraday's most important discovery? Why?	(See p. 73, par. 5)

to relate ideas to a larger frame of reference

What are the implications of Faraday's discoveries?

HENRY pages 76-84

to compare ideas, situations, characters

In what ways were the backgrounds of Henry and Faraday similar?	modest backgrounds

to show continuing progress in science

How did Henry improve upon Sturgeon's invention of the electro-magnet?	(See pp. 78, 79.)

to gain insight into human behavior

Henry did not patent his electro-magnet. Why?	(See p. 80.)

to identify traits of character

Did Henry's failure to patent his electro-magnet illustrate his concern for the welfare of his fellow man?	

to observe the influence of environment

How do you think his early environment might have given him a humanitarian point of view?	

to draw conclusions

Do you think the courts were justified in ruling in favor of Morse?	(See p. 81.)

to acquire understandings in the area of science

What was the principle involved in Henry's invention of the first motor?	transfer of energy

relating ideas to a larger frame of reference

On p. 82, par. 2, Henry is compared to Benjamin Franklin. Do you think this comparison is valid? Why?	

# # # #

BESSEMER pages 85-89

to gain insight into human behavior

Why do you think Napoleon III was willing to finance further experiments in developing Bessemer's new kind of projectile?

to grasp implications and to make inferences

In what way did Bessemer's search for a better material than cast iron seem to be inspired by monetary gain?

(See p. 85, Par. 1-2)

to note likenesses and differences

How does cast iron differ from wrought iron?

(See p. 86.)

In what ways does this method of discovery differ from a more scientific method?

(See Glossary - scientific method)

to recall information

Why was the manufacture of steel such an expensive process?

(See 86, par. 3.)

to understand the worth of perseverance

How did Bessemer solve the problem of producing an inexpensive steel?

(See p. 87, par. 2, "Experimentation")

When mass production produced a brittle steel, Bessemer was heaped with abuse. However, he continued his research. What do you feel might have compelled him to continue experiments, rather than accept defeat?

to relate ideas to a larger frame of reference

How has the production of inexpensive steel affected engineering achievements during the 19th and 20th centuries?

(See pp. 88-89.)

EDISON pages 128-136

to empathize with other people

Why did Edison's mother take him out of school? (See p. 129.)

What did his teacher mean by the word "addled"? (See p. 129.)

to evaluate bias in a person

In what ways do you think Edison's teacher and other persons as well could have misunderstood him? (See p. 129.)

to observe how strong characters came from seemingly adverse environments

What is meant by the term "self educated"?

How did Edison finance his early laboratory work? (pp. 129, 130)

How did Edison overcome bad luck and misfortune? (p.130)

to draw conclusions

What did the author mean when he said that Edison's opportunity to learn telegraphy was worth more than almost any amount of money? (p. 130. par. 4.)

Was Edison's decision to invent only needed items a wise one? Support your answer.

Why do you think Edison's invention of the light bulb was considered the climax of his life?

Why was Edison not considered a scientist? (p.135)

What is meant by the term abstract discovery," on p. 136, par. 1? (See Glossary) to relate ideas to a larger frame of reference

How do you think Edison's knowledge of telegraphy influenced his inventions?	
Would Edison have achieved fame had he lived 100 years earlier or 100 years later? Support your answer.	

to identify traits of character

Why did Edison decide not to invent anything unless it was needed?	useless expenditure of time and energy

to recall information

How was Edison able to work 20 hours a day?	cat-naps
Why was Edison called a Wizard?	(See p. 133.)

to understand the worth of perseverance

What did Edison mean when he said, "Genius is one per cent inspiration and 99 per cent perspiration"?	

# # # #

DARWIN pages 145-153

to observe the influence of environment

From what kind of background did Darwin come?	(See p. 146.)

to recall information

During Darwin's five year trip around the world, what observations did he make about the animals he studied?	(See pp. 146, 147.)
What did Darwin conclude about the animals he found in Australia?	(See p. 147.)

to estimate the influences of other lives upon the scientist
to recognize continuing progress in science

How did Darwin use the book by T. R. Malthus to help him reach his conclusions about change in species? (See pp. 148, 149.)

to acquire understandings in the area of science

What is meant by "natural selection"? (See p. 149, par. 2)

to note likenesses and differences

Wallace used the term, "survival of the fittest." In what ways did his theories agrees with those of Darwin?

to relate ideas to a larger frame of reference
to draw conclusions

In what way would Mendel's knowledge have been helpful to Darwin? (See pp. 151, 152.)

Darwin came to the conclusion that species change. What did he mean?

# # # #

CARVER pages 172-176

to gain insight into human behavior
to empathize with scientists of many types

Why do you think Carver was willing to give up his good life in Iowa to teach at Tuskegee Institute? (See p. 172.)

to observe how strong characters came from seemingly adverse conditions

Carver supported himself through school. What difficulties might this have caused him?

to draw conclusions

Why do you think Carver was determined to finish college?

Why do you think Carver had difficulty finding a college to attend?

to understand other times and places

Why was much of the land in the South worn out? (See p. 174.)

to estimate the influence of one person over another

How was Carver able to help the Southern farmer improve his land? (See p. 174.)

to relate ideas to a larger frame of reference

How did Carver use his knowledge of chemistry to promote a better standard of living? (See p. 175.)

Why do you think the Roosevelt citation read, "a liberator to men of the white race as well as the black."

# # # #

RUTHERFORD AND LAWRENCE pages 181-189

to estimate the influence of one person's life upon another

Why has the author written about both Rutherford and Lawrence in one biography? interdependence of one upon the other

Did these two scientists ever work together?

to grasp implications and make inferences

What do you think is meant by the first sentence on p. 181, "Rutherford was after big game"?

to acquire understandings in the area of science
to draw conclusions

Rutherford described the atom as a nucleus surrounded by particles which revolve about it in orbits, like planets. How did he reach this conclusion?

What is meant by the word, "bullets" as used on p. 181, par, 3?

relating ideas to a larger frame of reference

From your knowledge of the atom, what do you think is necessary to make one atom differ from another?

to recall information

What is meant by "smashing an atom"?

(See p. 187, par. 3.)

Why was the development of the cyclotron necessary?

On p. 188, the author describes radioactivity as a phenomenon. What did he mean?

(See Glossary.)

to recognize man's need for a moral-ethical attitude

In what ways can the use of nuclear energy be of benefit to mankind?

can take the place of present day sources of power (coal, water power, etc.)

LANGMUIR pages 177-180

to gain insight into human behavior
to recognize continuing progress in the field of science

Langmuir was active in research at the General Electric Co. Why do you think a privately owned industry would be interested in research?

humanitarian viewpoint
attempt to improve their own products

to appraise soundness of ideas
to understand the worth of perseverance

When Langmuir invented the gas-filled bulb, what method of investigation did he use?	experimentation

to relate ideas to a larger frame of reference

If man someday is able to control weather conditions, what benefits will be obtained for mankind?	vegetation possible in desert areas prevention of storms

# # # #

GUTENBERG pages 9-16

to build an appreciation of vocabulary
to recall information

What is meant by the word "technology" as used on p. 10?

to observe how success and failure stemmed from environmental conditions

Gutenberg died an apparent failure. What is your opinion?

To observe how ideas developed into forces in action

Why do you think the printing press was so rapidly adopted throughout the world?	man eager to learn propaganda value

to recall information

What were some of the results of Gutenberg's invention?	dissemination of knowledge need for schools

to draw conclusions

Why would you consider movable type one of the greatest inventions of mankind? Discuss your answer.

STUDY
OF
"B"
BOOKS

TEACHING SUGGESTIONS FOR THE USE OF THE "B" BOOKS

For the study of the "A" book, Breakthroughs in Science, guiding questions were given to help the child acquire understandings in the area of science and to improve his proficiency in the use of reading skills. The same kinds of questions can be used in the study of the "B" books. However, emphasis should be placed on the development of appreciations in the area of biographical literature.

Biography is a distinct form of literature. Most authorities consider it to be the most difficult form of writing. Unless well done, it may hold little attraction for the reader. This may be due to the lack of plot or to lack of suspense. However, biography may have greater impact upon children than fiction because the people and events discussed are presumably real.

Usually, biography is written in one of two ways:

1. An expository style, where the author has taken little liberty with events and ideas, but has set forth situations as they actually happened.
2. A narrative style, in which the author has presented events and dialogue as they might have happened, usually weaving the facts into a more suspenseful story.

The narrative or fictionalized style may be more appealing and appropriate for junior readers.

Most authors attempt to incorporate the following three qualities into their biographies:

1. Action and excitement
2. Human daring and courage
3. Humor and human interest

Children should be encouraged to evaluate how successfully the author has incorporated the above qualities. The less skillful writer may not be able to use these qualities in a manner that makes the story seem "true to character."

Mature reading of biography demands two major skills:

1. The ability to follow various patterns of organization
    a. Are the facts well organized?
    b. Are the important facts of the biography included?
    c. Is the sequence of events logical?

2. The ability to evaluate critically

   a. Are the events and facts authentic?

      Evaluation of authenticity will require research skills. Verifying information is a necessary part of critical reading, and the teacher should require occasional research in other biographies, encyclopedias, etc.

   b. Was the author qualified to write the biography?

      Was the author's purpose clearly understood by the children?
      Did the author show a close relationship to the subject?
      Was the author able to present ideas in a sound manner?

   c. Does the dialogue seem real?

      The dialogue should be appropriate to the character of the subject of the biography and to the time and places in which he lived.

   d. Was the author's style appropriate?

      Is there beauty in the language used?
      Has interest been sustained throughout the book?
      Is the book written in acceptable English?

SUGGESTIONS FOR A COMPARISON OF LITERARY QUALITIES

The four "B" books, Galileo, The Story of Albert Schweitzer, Louis Agassiz, and Robert Goddard, offer opportunity for a comparison of the literary qualities of biography. These four books illustrate differences that are readily apparent to the reader.

As an example, excerpts from each of the four books have been included to show the beauty of language. These can be read and discussed by the children. Stimulate discussion about the beauty of language and encourage children to share their opinions. Examples showing action and excitement also are presented for group discussion and evaluation. Additional examples of these two qualities should be discovered by the children.

Have children discover humorous situations in each of the books. Ask such questions as the following:

> Do you think this humorous event really happened?
> Does this event make the story more real to you? Why?
> How does this humor fit the "character" of the person?

Style refers to the way in which the author has written the book. The style should be appropriate to the characters in the book. It will be helpful for children to look for specific examples when discussing a style of writing. The following ideas will be helpful when discovering and comparing style:

Have children read and listen for

1. sound of the words used
2. clarity of expression
3. beauty of expression
4. richness of the language used

Have children discover

1. figures of speech (allegory, simile, parable, etc.)
2. descriptive style
   - economy of words
   - verbosity
   - attention to detail
3. dialogue
   - whether true to the character
   - whether appropriate to time and place
   - whether essential

Have children discuss

1. movement of the story
   - fast
   - slow
   - dull
   - active

2. accuracy of content (This may require research and could be a suggested related activity.)

3. acuracy of description
4. construction of the biography

BEAUTY OF LANGUAGE

GALILEO

"His restless brain sent hammers beating behind his temples" p. 1, par. 1

"The crowd began to chatter as noisily as the swallows when they came to nest in the lofty belfry at eventide." p. 30, par. 4

"He might wear a shabby coat and wonder how he could afford to pay for his humble lodging; yet guests with jewels gleaming among the rare laces at their wrists and throats listened attentively as he told of his hydraulic scales or described his demonstrations at the Learning Tower." p. 35, par. 1

"Moved by such saintly humility, Galileo prayed that he, too, might make so good an end." p. 42, par. 5

"In the year 1604 a new star of exceeding brilliance brightened the autumnal skies." p. 49, par. 1

"The die is cast, the book is written, to be read now or by posterity, I care not. I can well wait a century for a reader, since God has waited six thousand years for a discoverer." p. 63, par. 4

"While the others drank the toast, Galileo was forced to turn away to hide his tears." p. 87, par. 4

LOUIS AGASSIZ: PIED PIPER OF SCIENCE

"Let's take the short cut through the marsh," he suggested, looking off beyond the flats to where the beckoning peaks of the Bernese Alps, glittering with the snow of their eternal winter, stabbed the blueness overhead." p. 15, par. 5

"Louis stood poised for action, every nerve in his body alert. For a few minutes steel sheared against steel. Then Louis saw his opening. With only a fraction of a second to take advantage of it, his arm, wrist, and body moved with lightning-like speed". p. 36, par. 2

"As he struggled up an almost vertical white wall, Louis' heart thumped, his legs shook, and his head spun with giddiness. He had the strange sensation that every thing, even his blood, was frozen. Jacob, who was directly ahead of him, was the only sign of life in the gloomy desolation." p. 102, par. 8

"Cries of farewell arose as the coach, drawn by spirited horses, rumbled out of the coach yard off into the sleeping countryside." p. 113, par. 7

"Now his future stretched ahead of him like a foggy sea with no horizon." p. 124, par. 3

"His eyes rested in deep contentment on the encircling hills, silvery with olive orchards; on the yellow roads, with here a cart drawn by great white oxen, there a flock of sheep ambling toward the market." p. 88, par. 1

"Galileo's gnarled hands, once so subtle, tugged at the bed covering with something of their old strength; his eyes widened until Vincenzio drew back afraid. For a moment it seemed to him that his father could really see again." p. 167, par. 2

THE STORY OF ALBERT SCHWEITZER

"The hot wind caresses the leaves of the palm trees and brings the scent of tropical flowers. Strange sounds of wild animals are heard at frequent intervals." p. 3, par. 1

"It was a radiant June day. The sky was blue. The trees were in flower. The church bells were gaily pealing. The world was incredibly beautiful. Albert felt all this with an emotion so deep that it almost caused physical pain." p. 30, par. 2

"With all the world shaking its head at his folly, with his own heart at the breaking point, he never faltered. Albert Schweitzer's inner voice was stronger than all the voices around him. And it was this voice that he was ready to follow." p. 42, par. 3

"His heart full of grief, his head full of daily worries, Albert Schweitzer went about his tasks as usual from daybreak to sundown. But after his work was done, when only the cries of the wild animals interrupted the deep silence of the jungle night, he wrestled with the ever-recurring question which preyed so heavily on his mind..." p. 92, par. 1

"Looking out over the gently heaving blackness of the water flecked with chips of moonlight, he recalled that night twenty years ago..." p. 217, par. 4

"... as a dozen or so birds detache themselves from the throng and wadd down to the beach single file like absurd little men." p. 221, par. 1

ROBERT GODDARD, SPACE PIONEER

"Bob watched, fascinated, as the arrows leaped straight into the air one after the other, and then fell down, wobbling pretty much in the direction he'd planned." p.6, par.

"The carriage turned into the farmy and from around the corner of the b raced a small army of highly excite cocker spaniels, the little ones str gling to keep up with their elders. p. 14, par. 5

"Behind the barn, almost hidden by a scrubby growth of swamp maple, a nar stream made its way across the mead On its near bank there grew a fine cherry tree, much overgrown and chok with dead branches." p. 17, par. 2

"The house echoed with the rolling boom of thunder; the hospital room alight with the glare of one lightn flash after another. Tree branche crashed to the ground, barely miss the house." p. 52, par. 3

"The otherwise spotless carpet was covered with a small snowdrift of t white dots." p. 68, par. 8

"His words, his luminous face, his modesty, and his heart-warming sense of humor all combined to move everyone in his audience." p. 120, par. 3.

"Albert Schweitzer climbed up the steep narrow steps of the little wooden staircase which led up to the loft where the organ stood. He climbed them as nimbly and happily as when he was a little boy, and as thankfully as ever."
p. 152, par. 2

"It was an unusually clear morning, crisp and cold. There was only the sound of metal parts being assembled, and the cranking noise of 'September' being readied for action."
p. 80, par. 2

"Balancing her cup on one hand, she threw open the glass doors to the outside. Then, happening to glance down at her feet, she found herself looking into a pair of cold, beady eyes."
p. 101, par. 3

"During the day the wind continued to rise, with each successive blast outdoing the last, while the rocket team watched and listened anxiously."
p. 124, par. 2

ACTION AND EXCITEMENT

GALILEO

" 'We were just debating, ' the older man told Galileo, 'whether it is wise to make such a public demonstration. If it fails--' 'It will not fail,' answered Galileo sharply. He turned to speak to two of his most trusted students who waited at the door of the tower, each holding an hourglass." p. 29, par. 2,3

"The lad stuttered in his excitement. 'Master, I was just polishing these lenses as you bade me--' 'Is that any reason why you should start shrieking like a heathen savage?' 'But master, when I held up two at once to the light I saw -- But you will never believe what I saw when I looked through them!'
p. 73, par. 5

LOUIS AGASSIZ: PIED PIPER OF SCIENCE

"They had skated only a little way when they came to a place where a fissure yawned. For a moment it looked as if the adventure was over. But suddenly Louis dropped on his hands and knees. Leaning forward, he lay down and grasped the ice on the opposite side, forming a living bridge. 'Crawl across,' he commanded."
p. 22, par. 8
"

"But when the captain talked to Louis he was long-faced and pessimistic. "Because of the time of year we must expect the water level to keep falling." His eyes screwed up anxiously as he viewed the mud bar. "We could be stranded for weeks."
p. 199, par. 2

C

"He saw this letter in my hand, the long one sealed with the papal seal. He can read no more than I, being but a servant of one of the inquisitors of Florence; but he knew the seal. Only yesterday he saw a letter on his master's desk; it had just arrived and bore the seal. And he heard his master say--" p. 125, par. 11

" 'Then down on your knees and place your hand on this Bible.' With difficulty Galileo eased himself to his knees. A Dominican friar lowered the Bible that the old man might lay his hand upon it. Another attendant of the court handed the scientist a scroll." p. 145, par. 1,2

"Suspended over the bottomless well, Agassiz wondered how he could possibly escape. Suddenly the swing began to move upward; his companions had finally heard him. Louis had thought the ascent would be simple, but he noticed hundreds of javelin-like icicles he'd ignored during the descent. Their sharp spears pointing downward, could easily sever a rope." p. 100, par. 1

"The crew suspended their efforts to dislodge the grounded steamer when black, lowering clouds turned daytime into night. Thunder was followed by torrents of rain and ravenous gust of wind.....But in the process of rescuing the anchor, now sunk in mud, the rudder got broken." p. 201, par. 1

ALBERT SCHWEITZER

"Albert dropped his gun. He shouted to frighten off the birds and he fled, tears of shame and relief running down his cheeks. From this moment on, his mind was made up; never, never would he kill for the thrill of killing."
p. 15, par. 2

"Membership was by initiation only. Before becoming a member of this dreadful clan, the applicant had to drink the magic potion--human blood out of a human skull. From then on, he was bound to lead the life of a leopard, and to begin with, he had to kill a member of his family. The spell was such and the terror of reprisal so great, that no leopardman ever dared to protest against this ritual." p. 61, par. 1

"His excitement was great. What had become of the hospital? He had not expected to find it in exactly the state he had left it, but what he saw when the canoe finally docked at the landing brought tears to his eyes.
p. 106, par. 1

ROBERT GODDARD, SPACE PIONEER

"The possibilities of this situation were alarming. Dr. Goddard shuddered to think that in the twenty-four hours before the papers were recovered, they might actually have been on loan to enemy agents. Suddenly he realized how realistic the general's warnings had been. The Goddard rocket could be in danger of being turned against our own forces! Something must be done."
p. 60, par. 2

"Then Dr. Goddard pulled the release cable which anchored the rocket. For a few breathless seconds, which seemed like minutes, absolutely nothing happened. In these moments the rocket did not lift, but there was a flame and a steady roar. Then the rocket began to rise, like a reluctant beast from a long sleep. Gaining speed, it tore upward till it cleared the frame."
p. 80, par. 3

"One day a young boy of the Benjabi tribe was rushed in for an emergency operation. On the operating table, his face suddenly became rigid in horror. He had fallen into the hands of the dreaded cannibals! They were going to kill him and eat him. Those knives could mean nothing else. And there was no one who could tell him in his own language that it was not so."
p. 109, par. 3

"Schweitzer was outraged. How could the barbaric custom of hunting with pack hounds be glorified as a heroic action!" p. 165, par. 4

"In its sudden descent from five thousand to fifty feet, the little plane coughed but quickly recovered.
Dr. Goddard spent much of the last part of the trip with his eyes tightly closed." p. 91, par. 10

"It had seemed so, because the ascent had been perfectly vertical for a longer time than ever before. To make absolutely sure, the inventor and his men dashed off towards the point where the parachute had dropped out of sight, racing to see if any of the rocket vanes were still warm.
p. 112, par. 2

DETERMINING THE AUTHENTICITY OF BIOGRAPHY

It is difficult, without research, to make judgments about the authenticity of a biography. Children should first recognize the difference between biography and biographical fiction. The four books in this series are biography, although the author in each case has supplied imaginative events and dialogue of his imagination.

The student can arrive at some conclusion about authenticity by checking whether a bibliography or list of sources is given. If so, the adequacy of these sources should be considered.

Other biographies about the same person can be read or skimmed to verify the most important events in the subject's life. Sometimes, information can be checked in an encyclopedia, Who's Who, or other reference work.

If the biographer makes an attempt to describe scientific principles, the student should examine a reference work for verification.

Pupils can begin to practice distinguishing between obviously fictitious incidents and conversations in biography and those that might have been based on actual documentation.

DETERMINING THE BIOGRAPHER'S RELATIONSHIP TO THE SUBJECT

Good biographies should demonstrate the biographer's understanding of his subject. The discriminating reader should be able to appraise the relationship of the biographer to his subject. Many junior biographies have been criticized on the ground that they have been written hurriedly to fill a gap in the market. As children read more biographies, their judgments will become more acute and critical.

The author should be evaluated in terms of his access to and use of authentic information, his understanding of his subject, and his literary artistry.

VOCABULARY ENRICHMENT

The following list of words can be used for vocabulary enrichment. Have children try to use context clues to determine word meanings; then, verify meanings in a dictionary. Have children determine the root word, and, when possible, look for word derivation.

THE STORY OF ALBERT SCHWEITZER

page	word	page	word
1	caresses	82	renunciation
17	exhortations	84	impending
20	aptitude	86	paradox
25	erudite	88	conscripted
26	goose-stepped	95	wanton
28	theology	102	debilitating
28	ordained	104	alacrity
28	curate	105	alleviate
34	prudent	113	onslaught
36	ardent	114	mandibles
40	idealism	129	spurred
46	primeval	134	personnel
47	unalloyed	141	embodied
53	atrocious	152	oblivious
57	pervading	161	ascetic
58	pestiferous	161	superfluous
58	festering	162	longevity
64	emanated	164	venerable
67	lolling	167	philanthropic
76	palavers		

ROBERT GODDARD, SPACE PIONEER

page	word
9	scuffling
10	puzzlement
13	congealed
19	centrifugal
32	grievances
33	chivalry
35	conjugating
40	precarious
45	dilemma
54	intermittent
69	clamor
71	disintegrate
75	patrons
91	acreage
93	stagnant
93	improvising
94	concoction
95	geodetic
95	colleague
115	oxidizer
120	static

GALILEO

page	word
3	perspective
6	pungent
18	reproaches
24	dowries
25	rostrum
26	decorous
26	iconoclastic
31	felicitate
37	lineage
42	disputations
49	apparition
62	rancors
68	frescoes
72	vocation
78	begrudged
81	petulantly
82	cosmography
83	impiety
85	nominal
86	enmity
95	hierarchy
98	gormandizing
100	draught

GALILEO

page	word
111	apothecary
112	indolent
118	rakish
121	prerogative
126	overtaxed
128	inquisitors
129	ignominious
132	irreverently
139	amendations
140	infallible
145	abjure
145	heresy
147	legacy
155	doddering
163	allusions
163	mortal
170	canon

LOUIS AGASSIZ: PIED PIPER OF SCIENCE

page	word
14	naturalist
25	beseechingly
35	impetuous
53	interrogation
55	preoccupation
65	knotty
69	enumerated
69	lyceum
78	treatise
84	titanic
105	topographical
109	fossiliferous
135	grotto
141	thermometric
146	diffidently
155	omnibus
216	apoplexy
237	requiem

SYNOPSES OF "B" BOOKS

ROBERT GODDARD, SPACE PIONEER

by Anne Perkins Dewey

Robert Goddard, Space Pioneer, was a man who lived ahead of his time. From his early childhood, he dreamed of the day when man could circle the earth, visit the moon, and investigate the planets of the solar system.

This is the biography of a man who in 1914 built and fired the first liquid-fuel rocket. Robert Goddard was a true pioneer in the field of space travel, for his experiments and studies opened the way for the scientists of today.

As a boy, Robert was sickly, but a brilliant student. Sheer determination and perseverance helped him overcome illness, financial difficulties, and the the discouragement of a disinterested public. Nevertheless, there were a few scientists who saw the importance of his work, among them, Daniel Guggenheim, of the Guggenheim Foundation, and Charles A. Lindberg.

Ironically, the deadly German V-2 missile of World War II was almost identical with the Goddard rocket described in papers published in 1919. Abroad, Goddard was well known and respected for his work; although at the same time, he was relatively unknown in America. After World War II, visiting Germans were asked about rocketry. Imagine the surprise when the Germans admitted that all they knew was based on Goddard's research.

Mrs. Dewey has written this biography in narrative style. It is a readable account about one of America's modern pioneers.

GALILEO

by Elma Ehrilich Levinger

Galileo Galilei was a man of many talents. He was born into a noble family which had given a number of distinguished officials, artists, and soldiers to the state of Tuscany, but now knew only abasement and poverty. Somehow, the disappointed family dared hope that Galileo would eventually redeem the family forturne.

What should one do with a boy of such tremendous promise? He needed the discipline of books and of wise teachers who would win his respect for their learning. So young Galileo was sent to the monastery school at Vallombrosa. There, under the tutelage of the Benedictine monks, steeped in the knowledge of Aristotle and St. Thomas Aquinas, Galileo soon became a favorite pupil.

Elma Levinger tells a beautiful story of the hardships, struggles, success, and disgrace that were all a part of the life of Galileo. Galileo lived a very long and a very rich life. Obviously, much of the dialogue was the author's invention; but, always, the family and their friends seem to speak "according to character."

No attempt is made to labor over scientific principles and complicated theories. Instead, this is the story of a man and of his compassion toward his fellow man.

The reader will feel a kinship with Galileo and, like the white-haired scholar from Padua who "walked as proudly as a king" before his grave, will feel proud that the truth Galileo sought was vindicated before the world.

THE STORY OF ALBERT SCHWEITZER

by Anita Daniel

"The most important years in life are those between nine and fourteen. This is the time to plant the seeds of knowledge in the mind -- afterwards it is too late. This is the time to acquaint the young with the great concern for humanity, and perhaps tells us in a few words why it was possible for him to set aside two successful careers to devote his life to serving others through medicine.

At the age of twenty-nine, Albert Schweitzer had attained what few men achieve in a whole lifetime. He had won international respect and honor as a writer on theology, as an accomplished organist, and as a philosopher and teacher. Yet, despite his unusual success, he felt he needed to do something to give his life added meaning. But he had not yet found what he was searching for -- a satisfactory way to serve mankind.

By chance, he read about the African tribes who live and suffer in the steaming forests of the Congo. He knew his search was over. He resolved to become a doctor and go to Africa to help the sick and dying in the jungles of the Congo. In 1913, Albert Schweitzer, with his wife, left home, family, and friends to begin life anew as a missionary doctor in French Equatorial Africa.

Anita Daniel tells a believable story about Albert Schweitzer and gives the reader a vital and faithful portrait of a great man. As she states, "It takes more courage to respect life than to destroy it. Faith and love, the weapons Schweitzer chose, were much more difficult to use than guns."

LOUIS AGASSIZ, PIED PIPER OF SCIENCE

by Aylesa Forsee

Louis Agassiz, the son of a pastor, lived in a remote Swiss village. His father was determined that his two sons, Louis and Auguste, not only should receive an education, but that in so doing they should put forth their very best effort. To educate the boys, the family had to economize on many necessities. Both Auguste and Louis were very good students and excelled in their studies.

As a boy, Louis had an insatiable curiosity about living things, and, as a hobby, he collected fossils from the lakes and streams of Switzerland. Early in his life, he wanted to become a naturalist, but parental pressure forced him to pursue the career his father had decided upon for him -- medicine.

Even after Agassiz became a physician, his curiosity for living things never died. Burning with an almost fanatical desire to become an ichthyologist and geologist, he also continued his research in these fields. He developed a magical personality, which not only drew the attention of influential personages to his experiments, but bewitched them into giving him practical encouragement as well. His book on fossil fishes opened up a vast new field for later scientists to explore and enlarge, and his observations from a hut on one of his native Swiss glaciers provided proof for his theory of the Ice Age.

Agassiz later made his permanent home in America, as lecturer, teacher, explorer, writer, and founder of a unique natural-history museum. The record this book provides of his crowded, inspiring life as family man and naturalist will delight not only readers with a special interest in science, but also all readers who value selfless devotion to the cause of human knowledge and welfare.

STUDY OF "C" BOOKS

TEACHING SUGGESTIONS FOR THE USE OF THE "C" BOOKS

The "C" books are to be read independently by the children. Motivation for their reading should be done early in this study. Elements common to biographical literature should be discovered in these books.

The "C" books should be referred to at the reading hour, although they will not be studied formally. They should be used for discussion when the opportunity occurs.

In those books which are biographies, children should look for:

1. soundness of ideas
2. authenticity and accuracy of information
3. the author's purpose in writing the book
4. the organization of facts and sequence of events

Those books which are basically reference books can be used for:

1. independent reading
2. reference, to determine the authenticity of information contained in biographies

Sensitivity to the author's style should be evaluated through:

1. the use of figurative language
2. the connotation of words
3. the clearness of ideas
4. the ease of reading
5. the beauty of the language

Résumés will be found in the "C" section of this guide for all of the books for independent reading. The teacher should make use of these résumés as an aid to motivate the children to read independently. Children should read as many of the "C" books as possible. This will require an individualized reading approach.

The children should keep a record of their own reading of the "C" books. This can be done in many ways. The teacher should provide conference time with individual children, but should not require formal book reviews.

SYNOPSES OF "C" BOOKS

FIRST UNDER THE NORTH POLE; THE VOYAGE OF THE NAUTILUS

by Commander William R. Anderson, U.S.N.

SYNOPSIS

On August 3, 1958, the nuclear-powered submarine, "Nautilus," commanded by Commander William R. Anderson, U.S.N., made history by blazing a new Northwest passage under the polar ice-cap across the top of the world. It was a spectacular achievement. It was also a thrilling adventure, filled with nerve-racking moments of uncertainty.

This photographic picture book, written expecially for young readers by Commander Anderson himself, is the dramatic story, in non-technical language of Operation Sunshine and the events of the epic 96-hour voyage.

It is a succinctly written first-person account with a matter-of-fact approach devoid of heroics but, at the same time, giving credit to officers and crew for fortitude under action that was not without its hazards.

The numerous photographs are outstanding for clarity and interest and have been supplemented with diagrams showing cutaway views of the ship and with two excellent maps tracing the route of the "Nautilus" from the Bering Straits to England.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Commander William R. Anderson, U.S.N., was born in Bakerville, Tenn., and attended the Columbia Military Academy in Tennessee before entering Annapolis. He began his naval career in the submarine service during World War II when, immediately after graduation from Annapolis in 1942, he was sent to the Pacific where he participated in eleven war patrols and was awarded the Bronze Star.

By 1953, he was captain of the conventional submarine "Wahoo" which he commanded for two years. Then he was returned to land duty and became head of the tactical department of the Submarine School in New London, Connecticut. He was advanced to the rank of commander in 1955.

Assuming command of the "Nautilus," the first atomic-powered submarine, in June, 1957, Commander Anderson put into operation the plans and preparations for the arctic expedition. In their preliminary probes the crew conducted research, measuring salinity, temperatures, ice thickness, and depths.

On August 3, 1958, the "Nautilus" passed beneath the North Pole, thus pioneering a new sea route from the Pacific to the Atlantic. For this feat, the officers and men of the crew were awarded the Presidential Unit Citation; and Commander Anderson received the Legion of Merit Award for "farsighted planning, skilled seamanship, and thorough study of Arctic area."

Together with Clay Blair, Jr., Anderson is the author of a series of articles which appeared in the Saturday Evening Post in 1957 and 1958. He also has written articles for the U.S. Naval Institute Proceedings and for National Geographic Magazine. His books, NAUTILUS 90 NORTH and FIRST UNDER THE NORTH POLE, reporting the voyage were published in 1959.

Commander Anderson is married to a former air-line stewardess and has two sons. The family now lives in Mystic, Connecticut.

WORDS OF SCIENCE

by Isaac Asimov

SYNOPSIS

The vocabulary of science has always been a forbidding one, bristling with many-syllabled words and odd, unfamiliar terms. Now, Professor Asimov has opened up this language to the ordinary reader by conducting explorations into the roots and histories of hundreds of scientific terms.

The result is a fascinating book that combines a vast quantity of scientific information with an equal amount of language history. Simple origins can be found for even the longest "tongue-twisters." The author makes discovery of the origins of each word a satisfaction equal to that of following a clue in a detective story. It is a process that can't fail to stimulate the reader's interest and is a wonderful introduction to the sport of "word-chasing."

Asimov ways in his introduction, "... the scientific vocabulary is really an adventure. Hidden in the queer jawbreakers and in the shorter oddities are little stories, concise descriptions, thumbnail sketches of history, tiny bits of testimony to great scientific achievements and to human error, too... Far from frightening people away from science, the scientific vocabulary, looked at squarely and with understanding, should be one of the most powerful attractions of science. This book, I most earnestly hope, is evidence in favor of that view."

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Issac Asimov was born January 2, 1920, in the Union of Soviet Socialist Republic. His family migrated to the United States three years after his birth and Issac later became a naturalized American citizen.

He was brought up in Brooklyn and received his degrees at Columbia University --B.S. in 1939, M.A. in 1941, and Ph.D. in 1948. In 1949 he became an instructor at the Boston University School of Medicine and six years later was advanced to an associate professorship with biochemistry as his subject.

In his writings, however, he does not limit himself to the field of biochemistry, but deals with a large number of other subjects with equal ease. Asimov is particularly successful as an author of books for young people. Since 1950 he has published nearly 60 books, including several science fiction stories under pseudonym of Paul French. His most recent works are: BREAKTHROUGHS IN SCIENCE, THE KITE THAT WON THE AMERICAN REVOLUTION, THE REALM OF ALGEBRA, THE REALM OF MEASURE, SATELLITES IN OUTER SPACE, WORDS FROM THE MYTHS, WORDS ON THE MAP, WORDS OF SCIENCE, AND THE HUMAN BODY.

AMERICA'S FIRST WOMAN ASTRONOMER, MARIA MITCHELL

by Rachel Baker and Joanna Baker Merlen

SYNOPSIS

This is a warmly written full-length biography of a fascinating woman--shy, demure, honest, but also magnificently capable of exploring the universe, even though it meant defying a world that still believed "a woman's place is in the home." Her genius and persistence eventually won her recognition as a distinguished scientist and educator, and honors were conferred upon her. She became the first woman to be elected to the American Academy of Arts and Sciences, she was made a Fellow of the American Association for the Advancement of Science; and in 1922, 33 years after her death, she was elected to the Hall of Fame.

The authors describe Maria's childhood days, which were spent on the wild, windswept island of Nantucket, Mass. While still a little girl, she became fascinated with the stars, and despite her mother's opposition, found opportunities to stargaze with her father, who was an enthusiastic amateur astronomer. Night after night, the two would mount to the "widow's walk" on the roof and examine the heavens through a telescope.

At the same time, her father shared with her his vocation of adjusting and rating the chronometers of the vessels that harbored at Nantucket. This was a highly technical procedure which involved great precision and much astronomical and mathematical knowledge. Once, in an emergency, Maria rated a chronometer by herself--perhaps the most remarkable technical feat ever performed by a little girl.

Later she taught mathematics and became the town librarian, but every night she watched the stars. One night, through her telescope, she detected a faint light in an area that should have been absolutely dark. She had sighted a previously undiscovered comet. When her discovery had been recorded officially, she was awarded a gold medal by the King of Denmark.

When Vassar College was founded in 1865, Miss Mitchell became professor of astronomy and director of the college observatory, a post which she held until her retirement in 1888.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Rachel Baker was brought up in Dickinson, where, in her early teens, she was an assistant in the town library and a reporter on the small weekly newspaper. After graduating from high school, she attended the University of Minnesota and then spent several years in Europe. On her return, she married and began her career as a writer. She has had two children.

Her work as a journalist, a feature writer, and a contributor of medical articles to a national syndicate provided experience in writing factual materials in a readable style for popular consumption. Her interest in the medical field began as a child, when she read her father's medical books and journals.

Out of this background have come a number of excellent biographies for young readers, including: THE FIRST WOMAN DOCTOR, ELIZABETH BLACKWELL; DOCTOR MORTON, PIONEER IN THE USE OF ETHER; SIGMUND FREUD; CHAIM WEIZMANN, BUILDER OF A NATION; ANGEL OF MERCY, THE STORY OF DOROTHEA LYNDE DIX; AND AMERICA'S FIRST TRAINED NURSE, LINDA RICHARDS.

Mrs. Baker's interest in Maria Mitchell was first aroused when she and her daughter visited historic Nantucket, which had been Maria Mitchell's home. The mother and daughter decided to collaborate on a biography of this distinguished woman scientist.

Joanna Baker Merlen says, "When I was a little girl, growing up in New York City, the click of my mother's typewriter filled the apartment day after day." Sometimes Joanna was allowed to help. Her job was to read the manuscript and draw a red line through all the parts she felt like skipping.

While in high school, Joanna decided to be a writer herself and read avidly to see how other people wrote. Also, she took courses in creative writing when she attended Brandeis University and Boston University. She practiced doing research work by assisting her mother in verifying background details for whatever book was currently being written.

AMERICA'S FIRST WOMAN ASTRONOMER is the first published work in which Joanna participated as a joint-author.

ARCHIMEDES AND THE DOOR OF SCIENCE

by Jeanne Bendick

SYNOPSIS

While this volume presents the few known facts about the life of Archimedes, it is not so much a true biography as an account of his mathematical discoveries and inventions.

The author creates an interesting background by describing the daily life and customs of the people of Syracuse and Alexandria at the time Archimedes lived in these Greek colonies. She also describes the great Museum and Library of Alexandria that was the center of Greek learning for a thousand years. There scientists and scholars had no financial problems and were supported by the government while they devoted themselves to ideas and to research. It was there that Archimedes studied and experimented for years before returning to his native Syracuse.

At this point in the story, the author presents some of the important mathematical discoveries that Archimedes made and shows how he applied them to the practical uses of mechanics.

The book is written Jeanne Bendick's usual lively and highly readable style and is illustrated with her own sprightly drawings and meaningful diagrams.

This volume is one of the Immortals of Science Series, described in the background material on EUCLID AND GEOMETRY, by DeLacy.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Jeanne Bendick was born in New York in 1919. She attended the High School of Music and Art and, later, the Parsons School of Design, where she studied book illustration. In 1940 she married Robert Bendick, one of America's first television cameramen. They have two children, and the family moves back and forth between New York and California, according to the demands of Mr. Bendick's work.

When her husband joined the First Motion Picture Unit of the Air Force during World War II, Mrs. Bendick settled down to illustrating children's books. Dissatisfied with some of the science materials that she was asked to illustrate, she began to write her own books. At present, she has a list of about 30 volumes which she has written and illustrated, in addition to an equal number of books that she has illustrated for other authors.

Although she specializes in scientific subjects, Mrs. Bendick is amazingly versatile and has some successes in other fields as well. One of her most popular titles, THE BLONK FROM BENEATH THE SEA, is an imaginative and humorous piece of juvenile fiction inspired by the oceanarium, which was opened while the Bendicks were living in Palos Verdes.

Her most recent books include LIGHTNING, TAKE A NUMBER, ARCHIMEDES AND THE DOOR OF SCIENCE, THE FIRST BOOK OF TIME, THE WIND, and PUSHUPS AND PULLUPS.

THE SEA AROUND US

by Rachel Carson
Special Edition for Young Readers,
adapted by Anne Terry White

SYNOPSIS

Many books have been written about the sea, but none that presents such a comprehensive and well-balanced picture in a non-technical and fluent style. When THE SEA AROUND US was first published in 1951, it was an immediate success from both a scientific and a literary viewpoint. It became a best-seller and was reprinted a number of times.

In 1958, the book was brought out in a special edition for young readers. Anne Terry White, an accomplished writer for young people, adapted the text. She was successful in retaining the full flavor and much of the lyric beauty of the original work. A notable feature of this edition is the profusion of high-quality illustrations reproduced in full color.

Drawing upon geologic evidence and scientific interpretations, the author covers such aspects of the subject as the processes that formed the oceans of the world, the beginnings and evolution of marine life, the influence of tides and ocean currents, explorations of the depths, contours of the sea floor, the formation of islands, the shapes of ancient seas in comparison with the present ones, the effect of the wind on the surface of the ocean, the results of glaciation, and the mineral resources of the sea.

A concluding chapter describes how man first ventured out of sight of land and learned to navigate. An unusual feature is a two-page reproduction of a modern pilot chart of the North Atlantic. Prepared by the Hydrographic Office of the U.S. Navy, it reflects the great advances in knowledge and instrumentation made in recent centuries.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Rachel Louise Carson was born in Springdale, in 1907. Her literary talent appeared early, and, at the age of ten, she was contributor to the

St. Nicholas Magazine. At the same time, she evinced a love for nature and nature-lore, and, although she had never seen the ocean, was fascinated by everything relating to the sea.

When she enrolled in the Pennsylvania College for Women, it was with the intention of making writing her career. A course in biology, however, stimulated her scientific inclinations and changed the emphasis of her studies. In 1929, Miss Carson entered Johns Hopkins University for post-graduate study in marine biology and supplemented this work with courses at the Marine Biological Laboratory at Woods Hole, Mass., where she later became an instructor.

When, in 1936, she was offered a position as aquatic biologist with the U. S. Bureau of Fisheries, she accepted. This bureau later became The U.S. Fish and Wildlife Service, whose central objective is to "insure the conservation of the nation's wild birds, mammals, fishes, and other wildlife ... with a view to preventing the destruction or depletion of these natural resources." In this work, Miss Carson was able to combine her scientific knowledge and her writing ability as she prepared bulletins, leaflets, and other informative literature published by the Service.

Her first book-length work, **UNDER THE SEA-WIND**, appeared in 1941. This volume, subtitled "a naturalist's picture of ocean life," as summarized by its author as "a series of descriptive narratives unfolding successively the life of the shore, the open sea, and the sea bottom."

Pressure of war work, new and revolutionary developments in the science of oceanography, and other factors caused Miss Carson to postpone systematic work on her second book, **THE SEA AROUND US**, which was not published until 1951. It was an immediate success both from a scientific and a literary viewpoint and became a best-seller that was published in many editions.

Miss Carson's third book, **THE EDGE OF THE SEA**, published in 1955, is a study of the ecological relations of seashore animals on the Atlantic Coast. The author called it "a popular guide ... which will make people realize that the beach is more than a place to get sunburned."

Shortly before her death in 1964, Rachel Carson completed **SILENT SPRING**, a book that caused a furor throughout the nation. For years, conscientious scientists had been calling attention to the harmful side-effects caused by the extensive use of chemical pesticides. Miss Carson presented the case forcefully and dramatically, crystalizing the concern of conservationists already alarmed by diminishing fish and wildlife. She alerted the public to the danger of an "Age of Poisons" and made the whole nation realize how a fascination for chemicals unwisely used might indeed bring a day when no song-bird remained alive to greet the spring.

LIFT-OFF; THE STORY OF ROCKET POWER

by Charles Coombs

SYNOPSIS

"A rocket is nothing more nor less than a means of transportation. Its sole purpose is to carry something--called its payload--from here to there." Thus, the author opens his concise and clearly stated discussion of this timely subject.

Coombs takes the reader inside a rocket plant, shows exactly how rockets are made and tested, and explains the kinds of guidance systems used to keep them on course. He also describes the two major types of motors--those which burn liquid and those which burn solid fuels--and tells why rocket experts disagree about which type is better.

Although the book is brief, it is quite satisfactory as a basic introduction to the principles of rocketry and will stimulate the reader to further investigation. Many useful drawings by R. H. Foor are included.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Charles Ira Coombs is a native Californian. He was born in Los Angeles in 1914 and after graduation from high school, attended Riverside City College and the University of California at Los Angeles.

Before becoming a full-time writer in 1946, Coombs worked in a variety of occupations--farming, carpentry, merchandising, and methods analyzing for Douglas Aircraft Company. He also served as movie and television representative for Boys' Life Magazine.

His writings include numerous magazine articles, contributions to anthologies and textbooks, and a long list of books for young readers. His early works were mainly popular fiction for readers of junior and senior high school age. Such titles as YOUNG CIRCUS DETECTIVE, YOUNG INFIELD ROOKIE, and MYSTERY OF SATELLITE 7, are typical of this period of his development as as writer.

About 1958, Charles Coombs began to find the area of writing on which his current reputation is based--factual information in the aviation-aerospace field. Since 1960 he has published 10 highly readable, authoritative non-fiction works on various aspects of this subject. These include AIRMEN AND WHAT THEY DO; ROCKETMEN AND WHAT THEY DO; GATEWAY TO SPACE; ALASKA BUSH PILOT; B-70, MONARCH OF THE SKIES; LIFT-OFF; and AEROSPACE PILOT.

To gather material, the author, who once aspired to be a pilot, does much air traveling, with the cooperation of the military and the National Aeronautics and Space Administration. "The military is interested in having young people informed of aerospace plans and activity," he explains. "Hence I receive full cooperation within the bounds of security."

EUCLID AND GEOMETRY

by Estelle A. DeLacy

SYNOPSIS

Euclid is famous throughout the world for his textbooks on geometry, which have been in use for 2000 years. His exactness and accuracy of method have never been surpassed. The principles of his brilliant introduction to geometry are contained in the ELEMENTS OF GEOMETRY. It was this work that greatly extended the boundaries of mathematics and established the primary form of geometry.

While Mrs. DeLacy's volume presents the few known facts about Euclid's life, it is not essentially a biography so much as it is a history of geometry. Beginning with the mathematics of Egypt, it discusses the work of mathematicians whose theories formed the basis for Euclidean geometry, explains the place of mathematics in Greek education, and then outlines the ELEMENTS. Succeeding chapters give brief information about other works known to have been written by Euclid, some of which are no longer in existence.

The book shows evidence of scholarly research although no bibliography has been included. It is one of the volumes in The Immortals of Science Series, all of which have been carefully edited for accuracy and readability.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

The Immortals of Science Series

The Science Wall of Honor on the Charles A. Dana Hall of Science at the University of Bridgeport, Conn., is a memorial created in the spirit of the celebrated Hall of Fame for Great Americans.

The Science Wall of Honor commemorates and perpetuates the names of the world's Immortals of Science whose fundamental discoveries in the field of natural science have yielded the greatest benefits to mankind's fund of knowledge.

A world-wide poll was taken among leading scientists, educators, and editors to select the names of the first twenty-five Immortal--twenty-four men and one woman--whose names are inscribed on the wall.

The Franklin Watts Publishing Company is currently producing a series of books for young readers describing the lives and achievements of these scientists. To date, twenty volumes of the Immortals of Science Series are in print, including EUCLID AND GEOMETRY and ARCHIMEDES AND THE DOOR OF SCIENCE.

CENTURY: SECRET CITY OF THE SNOWS

by Lee David Hamilton

SYNOPSIS

In a city of frigid tunnels beneath the polar ice cap, the United States is testing its first nuclear city and making experiments designed to be of aid in colonizing the moon. Camp Century, a project of the U.S. Army's Corps of Engineers, with the cooperation of the government of Denmark, thrives under the ice in Greenlnad, 800 miles south of the North Pole. Scientists, soldiers, and soldier-scientists live, work, and play in this Arctic community which may provide many of the solutions to the problems of survival on other planets.

This is the story of how the under-ice city was constructed, of the men and machines used in the project, and of some of the important experiments that are being conducted. These experiments include the use of nuclear power for heat and light, as well as for construction; various types of clothing provided for the men; the food and water supply; arrangements for recreation; and health and medical measures.

The author uses a readable, well-paced style and has illustrated his account with many excellent photographs, some from official sources such as the Polar Research and Development Center (PR & DC), the Cold Regions Research and Engineering Laboratory (CRREL), and the Eastern Ocean Engineers (EOE).

TEACHER BACKGROUND ABOUT THE AUTHOR

Lee David Hamilton is a writer of books and articles on science and history and is currently the Science Editor of Junior Scholastic Magazine. His books for young people include LET'S GO TO WEST POINT and LET'S GO TO A DAM.

He was born in New London, Wisc., and holds a B.S. degree from the University of Wisconsin. He divides his home life between New York City and Appleton, Wisc.

THE WONDERFUL WORLD OF MATHEMATICS
by Lancelot Hogben

SYNOPSIS

This stunning book with its over-size pages and profusion of fascinating illustrations in full-color traces the development of mathematics and mathematical ideas from neolithic man down to the present. The author clearly shows how the development of mathematics paralleled the development of civilization.

Primitive man first began to count by placing one pebble for one object, two pebbles for two objects. Any quantity greater than three was "a heap." Slowly, through the ages, he learned to count and to measure, to multiply and to divide. As he extended the scope of his building, surveying, navigating, and he added to his store of mathematical ideas. Through trade, travel, and conquest there was a gradual interchange of knowledge among widely differing civilizations.

The author takes us into a wonderful world where such geniuses as Galileo, Descartes, and Newton established the foundations of modern mathematics. He concludes with a vivid description of the role mathematics plays in the technical marvels of the present.

Lancelot Hogben is an outstanding scientist with a gift for writing clearly and simply while still retaining vigor and enthusiasm. The tremendous success of this book with young readers is due partly to the skillful way in which mathematics is integrated with the development of civilization in its many aspects.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Lancelot Hogben is an internationally famous scholar of great distinction. A biologist and a statistician, he has done much through his popular writings to make scientific subjects intelligible to non-scientists. Among the best known of his books are MATHEMATICS FOR THE MILLIONS, SCIENCE FOR THE CITIZEN, and MATHEMATICS IN THE MAKING.

THE WONDERFUL WORLD OF MATHEMATICS was Hogben's first book for young readers. It was published ten years ago and is now regarded as a classic in its field. Since then, he has written two companion volumes, THE WONDERFUL WORLD OF ENERGY and THE WONDERFUL WORLD OF COMMUNICATION. The great bulk of his published work is of a scholarly and technical nature that is best understood and appreciated by trained scientists.

Hogben was born in Southsea, near Portsmouth, England, in 1895. He was a brilliant student and won several awards and prizes at Trinity College, Cambridge. As a college professor his career led him into widely different localities and types of work. He was a lecturer in zoology at the Imperial College of Science, a director of animal breeding research, a lecturer at Edinburg, and professor of zoology at McGill University and at the University of Cape Town. He has been research professor of human biology at the University of London, professor of natural history at the University of Aberdeen, and has occupied the chair of the department of zoology at the University of Birmingham. Since 1963, he has been Vice-Chancellor of the University of Guiana, at Georgetown, British Guiana.

Twice--once in 1940, and again in 1950--Hogben has made extended visits to the United States and has lectured under the auspices of scientific societies.

TEN MILES HIGH, TWO MILES DEEP; THE ADVENTURES OF THE PICCARDS

by Alan Honour

SYNOPSIS

When this book was written in 1957, the amazing Piccard twins were still alive and still working at scientific research in the stratosphere and in the ocean depths. Since then, both have died; Auguste in 1962, and Jean Felix in 1963. The foundations which they laid are of inestimable value to other scientists as they build upon them--both in the making of actual discoveries and in the invention of suitable vehicles for these specialized forms of exploration.

Readers will enjoy the zest with which the brothers tackled their problems and will be absorbed by the carefully detailed preparations for each hazardous trip, whether by balloon or by bathyscaphe.

The author uses a brisk and fast-moving style and succeeds in using adventure to develop science understandings.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Alan Honour was born in London in 1918 and was educated there until 1939, when he joined the Royal Air Force. Radio Intelligence assigned him first to Norway and France, and later to the Middle East, where he spent four years.

After the war Mr. Honour returned to London; but after only a short stay, he traveled, first to France and then to Italy, where he worked on film scripts. He now lives and works in the United States and has become a citizen of this country.

In addition to TEN MILES HIGH, TWO MILES DEEP, Alan Honour has written three books for young readers in the field of archeology. They are CAVE OF RICHES, THE STORY OF THE DEAD SEA SCROLLS; SECRETS OF MINOS, SIR ARTHUR EVANS' DISCOVERIES AT CRETE; and THE UNLIKELY HERO, HEINRICH SCHLIEMANN'S QUEST FOR TROY.

WOMAN DOCTOR OF THE WEST: BETHENIA OWENS-ADAIR

by Helen Markley Miller

SYNOPSIS

Bethenia Owens-Adair was the first graduate woman doctor in the American West. Venturing into a profession hitherto reserved for men, she fought prejudice and ridicule to become a great physician and a brilliant surgeon.

At the age of three, Bethenia was already a pioneer, for she jouneyed with her family on the first wagon-train to blaze the way from Missouri to Oregon. With her brothers, she helped with the farm work and herded cattle, becoming rugged and wiry in the process. She had only a few months of log-cabin schooling before she married at the age of fourteen.

Her marriage turned out to be an unhappy one. Her husband was cruel and shiftless; and she left him, braving the disgrace of a divorce. Ill from grief and exhaustion, with a sickly baby to support she determined to start a new life. She returned to school and suffered through the humiliation of learning to read and write with the first graders. Eventually she got enough education to become a teacher, but more than anything else she wanted to become a doctor--a career which at that time was virtually impossible for a woman.

Battering down prejudice and overcoming one obstacle after another, Bethenia graduated from a Philadelphia medical school in 1872 and returned to Oregon to practice. There, she was met by mistrust and belligerence. Even old neighbors and friends were outraged at her continued flaunting of convention. Eventually, however, she built up a practice and even became a qualified and highly successful surgeon. Today, Oregon is proud to acknowledge her as one of the state's leading pioneer citizens.

Her story is dramatic and inspiring--a record of triumph over nearly impossible obstacles--and the author's readable, warmly personal style makes Bethenia live again for young readers.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Helen Markley Miller is a westerner who since childhood has enjoyed reading and writing about individuals who contributed to the development of the West. After graduating from Iowa State Teachers College she applied for positions in various western towns and eventually landed among the mountains and sagebrush flats of Idaho, where, except for a few years spent in Washington and Utah she has remained.

After her marriage, she and her journalist husband spent weekends and vacations exploring old landmarks and gathering information and local color about pioneers and frontier life. With his encouragement she began writing.

Mrs. Miller's first biography for young people was BENJAMIN BONNEVILLE: SOLDIER-EXPLORER. This was followed by THUNDER ROLLING: THE STORY OF CHIEF JOSEPH and several works of fiction, all with western settings. Mrs. Miller became intrigued with the story of Bethenia Owens-Adair while doing research for another book. "This is the story I want," she decided. "That of a woman perceptive enough to know what she wanted and brave enough to fight for attainment in spite of all difficulties."

FAMOUS PIONEERS IN SPACE

by Clarke Newlon

SYNOPSIS

This collection of brief biographical sketches of space pioneers is written by a specialist in the field of aerospace developments. The material is authoritative and is presented in a succinct, straightforward, matter-of-fact style. It is a book that will stimulate the reader to further investigations.

The 17 men whose lives and achievements are recorded are arranged in three groups. The men who dreamed of traveling in space and who proved it could be done are presented first. Most of their proof was on paper only, but sometimes it was demonstrated with experimental rockets.

The second group of men took the theories of the first, and from them built the great space machines that have escaped the atmosphere and launched man into space.

Presented last are the men who have ridden the machines and have actually flown in space--the Astronauts and the Cosmonauts. These are the men who have orbited the earth and have seen, viewed it from 150 miles up.

A final chapter, "Manned Spacecraft of the Future," discusses the next steps in man's program to explore space in person. Brief outlines of Projects Gemini and Apollo are included.

The book includes a selective bibliography and photographs of the men discussed in the text.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Before World War II, Clarke Newlon was city editor and managing editor of newspapers in Dallas, Texas, and in Cleveland, Ohio. Commissioned in 1942, he served with the Air Force in England and France, and then as information officer for the Secretary of Defense. Newlon returned to Europe in 1952 for a NATO assignment.

Three years later, Colonel Newlon was assigned to the Pentagon as Chief of the Information Division of the USAF Office of Information Services, with supervision over all media branches--press, radio, television, pictures, magazines, and books.

In the summer of 1958, Newlon retired from the Air Force to become editor of "Missiles and Rockets," the nation's first technical news magazine devoted to aerospace. This job brought him into almost daily contact with the newly formed National Aeronautics and Space Administration, and the Atomic Energy Commission, and the Department of Defense units involved in space exploration.

His first book, 1001 QUESTIONS ANSWERED ABOUT SPACE, published in 1961, was followed in 1963 by FAMOUS PIONEERS IN SPACE. During this time, he also served as a technical space writing consultant to NASA and United States Information Service, as well as to industries working in the space field.

Clarke Newlon is married and has two sons in college. The family lives in Washington, D.C.

PIONEER SURGEON: DR EPHRAIM McDOWELL

by Josephine Rich

SYNOPSIS

Ephraim McDowell grew up on the Kentucky frontier in the latter part of the 18th century. While still very young he decided to become a doctor, so he immediately set about obtaining an education to prepare himself for his chosen profession. This was not an easy thing to do, since the McDowell family was far from wealthy and medical schools were expensive.

For a number of years, Ephraim worked with the local doctor in Danville, grinding powders, making cough syrups, and being as useful as possible. Later, he apprenticed himself to a Virginia physician with whom he worked for three years. At the end of that period, his father was able to finance him to two years in Edinburgh University, where he studied under the famous surgeon, Dr. John Bell.

For the rest of his life, Ephraim practiced medicine and surgery in the Kentucky country side. His fame lies in the fact that he was the first to perform an operation involving cutting into the abdominal cavity. He successfully removed an ovarian tumor long before the days of anesthesia and antisepsis. The author skillfully portrays the prevailing prejudices against such operations and the courage necessary for a country doctor to so risk his reputation--and even his life, for McDowell was threatened by a lynch mob when it became known what he had done. Only the fact that his patient recovered saved him.

The book is intriguing, not only in terms of the detailed medical information it imparts, but also because it vividly portrays the dedicated but well-rounded personality and the happy private life of this man who opened the way to modern surgery. Young readers will find it an inspiring and abosrbing biography.

TEACHER BACKFROUND INFORMATION ABOUT THE AUTHOR

Josephine Bouchard Rich was born in 1912 in Tamora, Nebraska. After graduation from high school, she attended the Washington Boulevard Hospital School of Nursing in Chicago and receive her R.N. in 1933.

She practiced her profession in the Washington Boulevard Hospital and became Director of the X-Rav and Emergency Departments. In 1935 she married Dr. James Sears Rich, a physician specializing in radiology. They have two children and now live in Lexington, Kentucky.

Mrs. Rich is the author of three biographies for young people: JEAN HENRI DUNANT, FOUNDER OF THE INTERNATIONAL RED CROSS; THE DOCTOR WHO SAVED BABIES, IGNAZ SEMMELWEIS; and PIONEER SURGEON, DR. EPHRAIM McDOWELL.

She does careful research for her books and writes enthusiastically and sympathetically about her subjects.

WORLD OF SCIENCE
by Jane Werner Watson

SYNOPSIS

In a foreword to this volume, the distinguished physicist, Dr. E.C. Watson, indicates the purpose of the book when he writes: "There is nothing more exciting than a really good idea and no ideas are more exciting than those of modern science. This book tries to communicate to you some of this excitement, to stimulate your imagination, and to increase your desire to know more. But it will also help you to understand what science is, what its spirit and methods are, and what it is trying to do. And at the same time it will provide some insight into what science offers to mankind in general."

The material in the book is well organized into several large categories: Geology, the Earth Sciences; Astronomy, the Science of the Heavens; Mathematics, Logical Deduction of Consequences; Physics, Matter and Energy; Chemistry, the Nature of Matter; Biology, the Life Sciences; and Engineering, the Applied Sciences.

Each of these large divisions is broken down into subdivisions of related parts, and the whole is throughly indexed.

The volume is an oversized one with double-column text and a profusion of colored illustrations consisting of photographs showing laboratory equipment and methods, diagrams, charts, and graphs.

Although the style is straightforward and concise, the author uses a scientific vocabulary that may be difficult for all but advanced readers. It is a book that could be used in conjunction with Asimov's WORDS OF SCIENCE.

TEACHER BACKGROUND INFORMATION ABOUT THE AUTHOR

Jane Werner Watson was born in Fond du Lac, Wisconsin, in 1915. She received her B.A. from the University of Wisconsin and two years later joined the Whitman Publishing Company as an editorial assistant. Later she became an editor and staff writer for the Artists and Writers Guild in New York.

Jane Watson is a person of wide interests who has traveled extensively in the Middle East, India, and Africa. In 1958 she was cited by the Los Angeles Times as The Woman of the Year in the field of literature.

Her husband, Earnest Charles Watson, is a distinguished physicist who has been a member of the faculty of the California Institute of Technology since 1919. The Watsons lived in Pasadena for many years and were prominent in the cultural activities of the city. They now reside in Santa Barbara.

Mrs. Watson is the author of a long list of books for children and young people. Many of them are on scientific or historical subjects. Her most recent works include: THE WORLD OF SCIENCE, SCIENCES OF MANKIND, GIANT GOLDEN BOOK OF DINOSAURS, GOLDEN HISTORY OF THE WORLD. She is also the author of many titles published in the Little Golden Book Series.

PIONEER OCEANOGRAPHER: ALEXANDER AGASSIZ

By Beryl Williams and Samuel Epstein

SYNOPSIS

To have a great and famous man as a father can be a serious handicap, especially for a son who chooses a career in his father's field. Alexander Agassiz, however, son of the eminent natuaralist Louis Agassiz, accepted his heritage as an inspiration rather than a deterrent and became an equally famous scientist in his own right.

Alexander was born in Switzerland, and came to America at the age of 14 to live with his father, who was teaching at Harvard. Intrigued with the mysteries of the ocean when he vacationed at Nahant, he began to collect and classify marine specimens. This was the beginning of a lifetime absorption in marine zoology.

He earned a degree in engineering at Harvard, and, being a more practical man than his father, who never made an adequate living for his family, Alexander became a world-renowned industrialist and made a fortune in copper mining. Much of his wealth was used to further the cause of science, both in supporting the Museum of Comparative Zoology founded by his father and in financing his own explorations of the oceans.

He invented and developed machinery for dredging the ocean bottom. He collected invaluable data on the distribution of marine life in relation to ocean currents. He investigated the formation of coral reefs in various parts of the world and worked out an acceptable theory about their formation. He wrote voluminous reports and scientific papers. Foremost, he was concerned with extending the boundaries of scientific knowledge in all its many branches.

This full-length biography presents an excellent, all-around picture of the man; his character, and his achievements. It is well-balanced in content between his personal life and his professional attainments. The authors plainly have quite obviously done a thorough job of research and have written in a stimulating, narrative style. The result is a highly readable account of an inspiring personality.

TEACHER BACKGROUND ABOUT THE AUTHORS

Beryl Williams and Samuel Epstein are a husband-and-wife writing team who have written over 70 books, on a wide variety of subjects, many of them for young people. They are known by several pseudonyms--Charles Strong, Martin Colt, Adam Allan, and Douglas Coe--but most of their works have appeared under their real names.

When asked about their formula for collaboration, they explain, "We both do research, and argue over the general plan, and then we divide up the actual work. Usually, each of us writes about one-half of the chapters in any given book; then we edit each other's work and smooth out the differences."

Beryl Williams was born in Columbus, Ohio. After she graduated from college, she was a reporter and editor of the Daily Home News and the Sunday Times of New Brunswick, N.J., and was assistant editor of the American Scholar. Since 1941 she has been a freelance writer and editor.

Samuel Epstein was born in Boston, Mass. After he graduated from Rutgers University, he did publicity work for an engineering firm. Later, he taught school and acted as science editor for the New Jersey Agricultural Experiment Station. During the war, he was a technical writer for the U.S. Army Signal Corps.

The Epsteins have been married since 1938 and live in an old farmhouse in Southold, on Long Island, N.Y.

GLOSSARY [1]

aboriginal	Relating to plants and animals that were first native to, or were first to exist naturally in, a given region of the earth.
adaptation	Changes in the structure, function, or form of plants and animals by which, over several generations, they become more able to survive in their environment.
alloy	A mixture of two or more metals soluble in each other when molten, then cooled to the solid state.
alpha ray	Physics. A stream of positively-charged particles called alpha particles, emitted in the decay of radioactive substances; one of the three rays (alpha, beta, gamma) given off by radioactive substances.
analysis	Chemistry. The determination of the component parts or elements of a substance or compound, qualitatively, quantitatively, or both.
animal classification	The division of the animal kingdom into related groups and subgroups. The divisions are phylum, class, order, family, genus, and species.
antibody	A substance developed by immunization or existing naturally in the blood and other body fluids, that counteracts bacterial infections.
antitoxin	An antibody produced in the body of an animal upon the introduction of a toxin and when extracted from the animal, used to immunize humans or animals against the same toxin.
aseptic	Free from microorganisms that cause infection.
astronomer	A scientist who studies the positions movements, sizes, physical features, and makeup of planets, stars, and other objects and materials in the universe.
atom	The unit particle of an element, composed of protons, neutrons, and electrons; also, the smallest particle of an element that, except for inert elements, can enter into chemical combination with the atoms of other elements.
atomic energy	Energy that is released when the nuclei of atoms disintegrated through atomic fission or combined through atomic fusion.

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[1] Compton's Illustrated Science Dictionary, F.E. Compton & Company, Chicago, 1963.

atomic fission	The process in which atomic nuclei are split, resulting in a release of energy; in a chain reaction, the splitting of an atomic nucleus, resulting in the release of neutrons which split other nuclei, in turn releasing other neutrons, and so on.
atomic fusion	The forcing together of the nuclei of particular atoms by means of great energy, producing atoms of greater complexity and releasing large amounts of energy; for example, the fusion of hydrogen atoms that produces helium atoms in the sun.
automation	Work performed by mechanisms that are self-regulating or automatic; especially, a series of such mechanisms for the refining or manufacture of products.
bacteria	Microscopic, one-celled organisms found in water, soil, air, and in living and non-living organic matter. Some cause disease, while others, such as those found in the soil, serve to break down matter.
balance of nature	A balance of population among the various plants and animals in a given area; sometimes referred to as natural equilibrium.
Bessemer converter	A large, pear-shaped metal container, used in the production of steel, in which a blast of air is forced through molten iron to remove carbon, silicon, phosphorus, and other impurities.
beta particles	Electrons moving with velocities approaching 99 per cent of the velocity of light. Beta particles are given off by atomic nuclei in their radioactive disintegration.
beta rays	A stream of electrons, or negatively-charged particles called beta particles, emitted in the decay of radioactive substances; one of the three rays--alpha, beta, gamma--given off by radioactive substances.
biologist	A scientist who studies all types of living things, including their physical structure and function, their natural habitat, their development from prehistoric times, and all other matters related to their life activities.
booster rocket	An auxiliary rocket that is used to assist in the take off of a larger rocket.

botanist	A scientist who studies the structure, life processes, relationships, and distribution of plants on the earth.
calculus	The branch of mathematics that uses the concept of limits in the study of the rate of change or the change in the value of a function with respect to the variable or variables under observance; also, the application of tangents to curves, of areas of surfaces bounded by curves, volumes of solids bounded by curved surfaces, and to velocity and acceleration.
capillary	Any one of the tiny blood vessels connecting the arterioles to the venules, forming a network throughout most of the body.
cathode rays	A flow of electrons driven at high speed from the heated cathode of a vacuum tube by its high negative voltage.
chain reaction	A continuing chemical process in which the energy released by one process promotes one or more other processes; also, a disintegrative process within the nuclei of atoms in which enough neutrons are released by fission to produce fission in nearby atoms until all fissionable atoms within range have been disintegrated.
chromatic aberration	The failure of a lens to bring the different colors in light to a single focus, resulting in color effects along the edges of the images of objects. Chromatic aberration is caused by unequal refraction of colors passing through the lens.
cloud seeding	Scattering chemicals, such as dry ice or silver iodide, in a cloud that has a potential for producing rain.
concave	Having the shape of, or similar to, the interior surface of a hollow ball or the interior of a curved line.
conservation of energy (law of conservation of mass)	A principle stating that the total amount of matter in a closed system is constant. According to this principle, matter can be changed from one form to another, but never created or destroyed, except in nuclear reactions.
constellation	An apparent group of stars named after an animal, mythical figure, or object; also, as used by astronomers, definite areas of the celestial sphere marked off by imaginary boundary lines.

convex	Curved or rounded, as the surface of a ball seen from the outside; opposite of concave.
Copernican system	The theory, stated in the sixteenth century by Nicolaus Copernicus, that the earth is a planet rotating on its axis and revolving around the sun.
cosmic rays	Radiation that bombards the earth and its atmosphere and that apparently originates in outer space.
cyclotron	A device to bombard atomic nuclei, having at its center the two halves of a cylindrical box placed between the poles of a powerful electromagnet. The halves are evacuated and alternately charged by an oscillator. Protons, deuterons, and other charged particles are consequently accelerated in a spiral path from the center to a high energy level at the outside where they bombard atomic nuclei.
Darwinism	The theory of evolution advanced by Charles Darwin. The theory states that all species of plants and animals develop from earlier forms by a process known as natural selection. According to the theory, successive generations produce offspring with characteristics slightly different from their own. Individuals whose characteristics best suit their environments survive and reproduce, and after many generations, a new species may be produced through this process.
deduction	A method of reaching a conclusion based on certain premises or statements in which reasoning moves from general ideas to specific examples; also that which is deduced; also, the process of taking away from or subtracting, or that which is taken away.
deduction method	A process of reasoning in which specific conclusions or applications are drawn from general rules or premises.
direct current	A flow of electrons in only one direction, as opposed to alternating current; abbr., D. C. or d. c.
disinfectant	A chemical substance that destroys or reduces in number bacteria and viruses capable of causing disease; also, a substance manufactured for antiseptic use on inanimate objects rather than on living tissue.
disintegration	Physics. The partial breakdown of a radioactive nucleus by the emission of an alpha or beta particle; also the total or partial breakdown of nuclei resulting from a collision.

dominant trait	In genetics, one of a pair of opposite Mendelian characters that dominates over the other when factors for both are present in the germ plasm.
dry ice	A solid form of carbon dioxide, CO_2 having a temperature of -78°C. (-103°F.) or less. Dry ice changes directly from a solid to a gas at warmer temperatures and is useful as a refrigerant, expecially for foods in transit.
ecology	The study of the relationships among living organisms and between living organisms and their environment.
Edison effect	The emission or liberation of electrons from an incandescent filament that is generally heated by an electrical current; also the flow of emitted electrons from a heated wire to a nearby positively-charged plate.
Einstein shift	In a light spectrum a slight moving of lines toward the red.
electricity	A form of energy having the electron as its fundamental unit. When the electrical charge is at rest, it is referred to as static. When in motion, it is referred to as current.
electron	An elementary electric particle having a unitary negative charge and found in the shells of atoms and in static or current electricity; a unit particle of electricity.
evolution	The continuous process of the development of a species from its earliest stages of life.
experiment	A series of planned steps performed to test a hypothesis, solve a problem, or discover new information.
fauna	The animals found in a specific region or time; also, a listing and description of all the animals of an area or region; contrasted to flora.
fluorescence	The phenomenon characteristic of certain substance by which radiation is absorbed, and different radiation is given off. The phenomenon continues only so long as radiation is being absorbed. When the absorbed radiation is electromagnetic, the radiation given off is always of a longer wavelength.
galaxy	Any of the systems of millions of stars, nebulae, gases, and dust.

galvanometer	An instrument used to measure an electric current or, in some cases, simply to detect a current.
gamma rays	Electromagnetic waves of extremely short wavelength (very high frequency) having their origin in the nucleus of an atom.
genetics	The science concerned with heredity and variation.
germ	Any microorganism, but especially any of the disease-causing bacteria; also, any small developing combination of cells, such as a fertilized egg, a seed, or a bud.
germ theory	The theory of biogenesis stating that each living organism has its origin in some other living organism and cannot be produced from non-living matter.
gravity	The force of attraction between two bodies: the attraction of the earth's mass for all objects on or near the earth.
habitat	The natural living place of an animal or plant.
hybrid	An offspring resulting from the crossing of parents differing in hereditary traits; the offspring often developing characteristics different from those of either parent.
hypothesis	The conditional part of a statement of implication; also, the set of conditions of a theorem that are given as assumed or known. Something held to be true because it seems to explain adequately the available data or observations.
incandescence	The glow or radiation given off by an object that has been heated to a high temperature. Incandescence may occur in a solid, a liquid, or a gas.
induced current	An electrical current set in motion through a conductor by a magnetic field moving or varying relative to a conductor.
induction	Physics. The production of an electric charge or magnetic field in an object caused by the object's being near an electrically charged body or in a magnetic field originating in another object.
inductive method	The act of reasoning from a particular instance or particular instances to a general conclusion.

inertia	The characteristic of all matter that causes it to stay at rest, or stay in constant motion, unless an outside force acts upon it. It is a property independent of gravity and may be measured by any one of several units of mass.
inoculation	The introduction of microorganisms, serums, or other infective materials into an animal or a plant,causing a production of antibodies within the organism and resulting in immunity to the infection thus introduced.
interdependence	*Biology*. Mutual reliance of living organisms on one another for food, support, growth, or development. For example, birds require plants for protection and food; but, in turn, contribute to the survival of plants by eating harmful insects and transporting seeds.
ion	An atom, or group of atoms, that has gained or lost one or more electrons and is therefore electrically charged plus or minus.
isotope	An atom that differs from another atom or other atom of the same element because it has a different number of neutrons in its nucleus.
light-year	The distance that light travels in one year, or about six trillion miles.
luminescence	The emission of light from any substance that is not incandescent. The energy that excites the emitter may come from a chemical reaction, from mechanical action, or from some other source.
magnet	An object that will attract iron by a force other than gravitational, electrical, or nuclear.
magnetic induction	The phenomenon by which voltage, or electromotive force, is produced in a conductor moving through a magnetic field; also, the phenomenon by which an unmagnetized piece of iron, or other material, becomes a magnet as a result of being placed in a magnetic field.
magnetism	That group of phenomena involving forces of both attraction and repulsion and associated with electrical charges moving in a conductor (as an electric current) or with spinning electrical charges (as in an atom); in particular, events that occur in a field of influence by a magnet.

Mendel's laws	The three fundamental principles of inheritance; the law of unit characters, the law of dominance, and the law of segregation. The law of unit characters states that inherited characteristics are determined and transmitted by individual but paired factors. The law of dominance states that when two contrasting factors occur in an organism, one suppresses the expression of the other. The law of segregation states that factors are separated and redistributed by chance during sexual reproduction.
meteorology	The science that deals with the atmosphere and all weather conditions; the science of weather.
natural selection	The theory advanced by Charles Darwin to explain the causes or mechanism of organic evolution.
negative ion	An atom, or a group of atoms, that has gained one or more electrons and consequently has a negative charge.
neutron	A subatomic particle with no electric charge but with a mass about the same as a proton. It occurs in all atomic nuclei except that of the hydrogen isotope that has an atomic mass of one. It is emitted from the nuclei of certain atoms as a result of such nuclear reactions as fission.
Newton's laws	Three principles concerning motion: (a) Every object remains at rest or moves at a constant speed in a straight line unless made to change because of some outside push or pull; also called the principle of inertia; (b) Change of motion is in direct proportion to the force producing it and is in the same direction as the force; (c) To every action there is a reaction that is equal in force and opposite in direction
Pasteurization	A process of heating milk or other food products to a temperature of approximately 150°F. for about thirty minutes, followed by rapid cooling. The process kills or deactivates the bacteria that cause infectious diseases and delays souring or fermentation.
phenomenon	A fact or occurrence that may be described and explained on a scientific basis; sometimes an unusual or rare fact or occurrence.
phosphorescence	An emission of light from a substance after the energy source that stimulated the light emission is removed.

piezoelectric effect	The phenomenon by which an electric voltage is produced between opposite ends of certain crystals when pressure is applied so that the crystal is shortened slightly; also the reverse effect by which an applied voltage causes a crystal to expand or contract. Most practical applications involve vibrations rather than single movements, and alternating rather than direct current.
pitchblende	The mineral uraninite, mostly UO_2, that is a black lustrous, dense mineral ore containing uranium, radium, thorium, and lead and is the chief ore of uranium.
proton	A subatomic particle with an atomic mass of one and an electric charge of plus one. It forms the nucleus of an ordinary hydrogen atom, and at least one is contained in the nucleus of every atom.
radiation	The process by which energy is emitted and transmitted. The transfer of mechanical, electromagnetic, or nuclear energy through a given medium.
refraction	The change in direction of light waves or other energy waves when they pass obliquely from a medium of one density into a medium of a different density, or from a region of one density into a region of different density within the same medium.
relativity theory	An explanation of phenomena involving light, time, and space based largely on the hypothesis that the measured speed of light has a constant value regardless of the relative motion between the source and the observer. Relativity is used to predict the interchangeability of matter and energy, as expressed in the equation $E=mc^2$, developed by Albert Einstein; also called the relativity theory.
satellite	A celestial body that orbits about a larger body, as the moon revolves around the earth.
science	The organized body of knowledge about the physical universe, its components, and phenomena. It includes the attitudes related to, and those methods applied in, the search for new knowledge.
scientific method	Generally, the procedures used by scientists in the systematic pursuit of new knowledge and the re-examination of existing knowledge.

Solar system	The sun, the nine planets, the satellites of the planets, the asteroids, and the meteors and comets; generally, all celestial bodies within the orbit of Pluto.
species	A group of plants or animals so similar in structure and hereditary traits that their various forms will normally interbreed for successive generations. Species is the classification unit below genus.
specific gravity	A measure of the relative heaviness of lightness of a substance. It is the ratio of the weight of an object to the weight of an equal volume of water.
spectrum	A visual image, as in a rainbow, of the colors that make up white light; also a separation by wavelength of energy, such as light or x-rays, or a separation of a stream of subatomic particles, such as alpha or beta radiation, by the different energies of the particles; also, an analysis of all electromagnetic radiation into its component parts.
spiral galaxy	A huge, rotating star system containing a prominent nucleus of stars centered in a disk of stars and gaseous dust in the form of spiral arms. It is sometimes called a spiral nebula and usually contains more than a billion stars.
spontaneous generation	A theory, now disproved, that living organisms found in decayed or dead organic matter were produced by and from such matter; also called abiogenesis.
steel	Nearly-pure iron in which a small amount of carbon is dissolved. It may contain other elements, such as sulfur and phosphorus that are impurities, or nickel and chromium that give the mixture desirable properties.
subatomic particles	Particles smaller than atoms, or fragments of atoms that are produced when the nucleus of an atom is disintegrated. More than 30 different types are known, including protons, neutrons, electrons, positrons, antiprotons, mesons, and deuterons.
sun	The star at the center of the solar system, around which the earth and the other planets revolve. It has a diameter of 864,000 miles, a surface temperature of about 5,500°C. and a mass 332,000 times that of the earth. It is about 93,000,000 miles from earth.
sunspots	Spots on the surface of the sun that usually have a dark inner region, or umbra, surrounded by a less-dark outer region, or penumbra. The spots have a temperature of about 4,000°C., while the average surface temperature of the sun is 5,500°C.

supernova	A star that appears to explode and that is sometimes bright enough to be seen in daylight. It may reach a brightness 100 million times the real brightness of the sun. Only three supernovas have been observed in our galaxy during the past 1,000 years.
theory	An established or accepted explanation of relationships among observed scientific facts, events, or phenomena; also the result of a verified hypothesis; also sometimes a hypothesis concerned with major phenomena.
toxic	Referring to, or caused by, a poison; poisonous.
toxin	Any poison produced and secreted by an animal or plant organism as a metabolic by-product. When disease is caused by the toxin of parasites, the host may produce counteracting antibodies called antitoxin.
transformer	A device that changes the voltage of an alternating electrical current. A transformer contains no moving parts and in its simplest form is made of two coils of wire that are insulated from each other. Alternating current in the primary coil induces a current in the secondary coil. A transformer may also be a device that transfers electrical energy from one circuit to another without an actual electrical connection between them.
universe	The entire celestial cosmos, observed or postulated, in which all matter exists and all events occur.
vaccination	The injection or intake of a vaccine into the body to produce immunity to a disease.
vaccine	A suspension of killed or weakened microorganisms, of the toxins they produce, or of both, used for the prevention of an infectious disease.
vacuum tube	A glass or metal container from which most of the air has been removed and that is usually used to provide a space through which electrons may move freely between mental plates, called electrodes, that are mounted inside.
X-ray	One of several penetrating electromagnetic radiations of very short wavelength that occurs between the wavelengths of ultraviolet radiation and gamma rays.

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